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Review of Human Development Indices
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Abstract

This report is intended to support the Development Policy and Finance (DPAF) team's work on using holistic measurements of human development. We review the current body of literature exploring the theories behind holistic human development measurements and the tradeoffs of different methodologies for the construction of human development indices. Through a review of published and grey literature in the fields of human, international, and economic development we identify 22 current indices that aggregate measures from multiple components of human development. We analyze these indices to identify tradeoffs related to their unique characteristics and construction methodologies. We evaluate how index calculation might influence their relevance to different user groups, considering methodology, ease of calculation, ease of interpretation, coverage of different measures of human development, and comparability. Finally, we assess evidence of index traction, based on the number of countries for which they are measured, the frequency of their calculation, and measures of use and recognition by academics, the media, and development organizations and practitioners. The report is accompanied by an appendix of summary tables for each index with further details regarding background information, methodology, index components, and evaluation criteria addressed within the report.

Introduction

Human development refers to the measurement of a country's progress by analyzing citizen well-being (Sen, 1984; Alkire, 2010). Definitions of human development are often vague, and may be tailored to reflect the missions of international organizations. For example, Table 1 charts the many dimensions of development that the United Nations Development Programme (UNDP) has included in its definition of human development over the last two decades (Alkire, 2010).

Table 1. Changes in components of the UNDP's definition of human development over time

Dimensions mentioned by year	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02	'03	'04	'05	'07	'09
Long healthy life	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Knowledge	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Standard of living	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Political freedom	■	■						■										
Human rights	■					■				■								
Self-respect	■					■				■								
Physical environment		■	■		■													
Freedom of action & expression			■															
Participation				■	■								■					
Human security					■		■											
Political, social, and economic freedoms						■		■	■									

Being creative						▓		▓	▓							
Being productive						▓		▓	▓							
Freedom					▓	▓										
Democracy					▓											
Dignity & respect						▓										
Empowerment							▓		▓							
Community							▓	▓	▓							
Security									▓								▓
Sustainability									▓							
Political & civil freedoms													▓			
Cultural liberty														▓		
Social and political participation															▓	
Civil and political rights																▓

Source: Adapted from *Table 2: Dimensions mentioned in different reports*, in *Human Development: Definitions, Critiques & Related Developments* (Alkire, 2010).

As illustrated in Table 1, the concept of human development attempts to capture citizen well-being through a variety of development components, paying considerable attention to measurements of health, education, and standards of living. In addition, it is a living concept that can be – and is often – transformed each year by different organizations. Most international organizations agree that human development is a complex concept and must be measured by multiple development indicators (OECD, 2001; United Nations Development Programme, 2015b; Oxford Poverty & Human Development Initiative, 2007; World Bank, n.d.).

Measuring Progress: GDP and its limitations

Gross Domestic Product (GDP), developed in 1944 as an indicator of economic growth, has historically been interpreted as a measure of a country's progress (Dickinson, 2011). GDP is the sum of the value of all goods and services produced by a country each year, and is valued for its relative ease of interpretation (OECD, 2015; Ray, 2014; Porter, 2014). Its wide global use has also allowed for comparisons across countries and over time (OECD, 2015).

GDP, however, was never intended to be a comprehensive measure of well-being (Dickinson, 2011). The measure has been widely critiqued as an indicator of development since its emphasis – intentionally so - is on economic growth, not social or sustainable progress. GDP rises with the acquisition of goods and economic activity, even those at best weakly linked to "sustainable development" (such as environmentally destructive mining activities, or costly lawyer's fees for settling disputes) (Natoli & Zuhair, 2011). In addition, some activities clearly linked to social welfare, such as public education spending, are counted as consumption in GDP, rather than as investments in future economic growth (Dickens et al., 2006). Despite this, the popularity of GDP has often implicitly or explicitly led to a GDP-wellbeing connection in economic and policy debates (van den Bergh, 2009). Indeed, the prominence of GDP is argued to allow economic issues to dominate policy agendas, sometimes to the detriment of social issues (Atkinson et al., 1997; Perrons, 2012). Many critics have argued that income growth and material consumption alone are not sufficient for basic human needs, and that economic growth is therefore an ineffective substitute measure for social progress (Day, 1971; Encarnacion, 1964; Tversky, 1972; van den Bergh, 2009).

A second critique of GDP is that it does not take into account income distribution within a country. This failure to account for intra-country income distribution means that a country's GDP can increase even if only a small portion of its citizens became wealthier (Sen, 1976b; Sen, 1979). More generally, relative income is not considered when measuring GDP, even though a well-established literature has shown that regardless of economic growth, one's relative standing in a society can affect citizen happiness and well-being (Frank, 2005; Layard, 2005).

Another critique is that GDP does not account for social or external costs or benefits within a society. Van den Bergh (2009) argues that GDP's calculation "covers activities and transactions that have a market price," and therefore neglects many non-market transactions or informal markets in a country. For instance, activities like volunteer work and childcare are not included in GDP although they provide positive value in a society. Negative environmental externalities and resource

depletion are similarly unaccounted for. Van den Bergh (2009) notes that "if air, water, or natural areas are being polluted any resulting damage does not enter GDP, but when pollution is being cleaned this will increase GDP."

Some research has also challenged the validity of GDP as a consistent measure of economic progress across different countries. For example, Menkhoff & Luchters (2000) highlight that people with similar incomes in different countries might have different levels of support for public investments in health and education – differences which may not be fully accounted for in GDP. Gentilini & Webb (2008) support this argument, noting that while one country may have a low GDP per capita, its levels of poverty and hunger could be lower than those in a country with a high GDP per capita that suffers from high levels of poverty and hunger.

<u>The Human Development Index (HDI)</u>

These criticisms of GDP as a measure of human development have led individuals and international organizations to propose alternative measures of well-being that attempt to more accurately quantify human development, the most well-known of which is the Human Development Index (HDI) (Sen, 1984; Alkire, 2007). The HDI arose out of work in the 1980s by Amartya Sen who developed the Capabilities Approach, an economic theory positing that freedom to achieve well-being is a matter of what people are able to do (Sen, 1984; Alkire, 2007). While at the time conventional assessments of development were based on measures of per capita income, Sen argued for focusing on variation in people's choices and capabilities as a measure of human development (Sen, 1984; Robeyns, 2011). Such development, he argued, could be measured by three key dimensions: the ability to lead a long and healthy life, the ability to acquire knowledge, and access to decent standards of living (Alkire, 2007). The focus on these three dimensions stressed the importance of identifying income growth as only one means to development, rather than an end in itself (Sakiko, 2003).

With guidance from Sen, in 1990 the UNDP published the Human Development Index (HDI), the first attempt to develop a comprehensive indicator to measure a country's progress in human development (Sakiko, 2003). The HDI enabled the UNDP to rank countries based on a composite of measurements across multiple sectors (Alkire, 2010) and the theory behind it has inspired the development of other comprehensive indices, such as the Multidimensional Poverty Index (MPI), Gender Inequality Index (GII), and Social Progress Index (SPI). Although major development organizations differ in their definitions of human development, Sen's Capabilities Approach remains a fundamental theory in human development measurement and research.

<u>Beyond the HDI: The Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs)</u>

In 2000 the United Nations (UN) launched the Millennium Development Goals (MDGs) to track multiple components of human development including education, health, standard of living, gender equality, and environmental sustainability (United Nations, 2005). The goals and related human development components are as follows:
1. Eradicate Extreme Poverty and Hunger (standard of living)
2. Achieve Universal Primary Education (education)
3. Promote Gender and Equality and Empower Women (gender equality)
4. Reduce Child Mortality (health)
5. Improve Maternal Health (health)
6. Combat HIV/AIDS, Malaria, and Other Diseases (health)
7. Ensure Environmental Sustainability (environmental sustainability)
8. Global Partnership for Development (social development and governance)

Annual MDG Progress Reports across countries identified the goals in which targets had been met, goals in which there had been insufficient progress, and goals in which there had been no progress made in the last year (United Nations, 2014). MDGs are monitored using 21 measureable targets and 60 indicators that address the objectives of each goal (United Nations, 2014). The relative simplicity and global scope of the goals made the MDGs one of the most prominent initiatives on the global development agenda and an important dashboard for measuring human development (Alston, 2005).

The goals also faced significant criticism, however, especially as the MDG deadline of 2015 approached. Critics alleged that the MDGs emphasized failure in Sub-Saharan Africa, failed to consider within-country inequality, unfairly directed foreign development aid, and in some cases simply served as a distraction (Kabeer, 2010; Brown & Beattie, 2015; Alston, 2005; Easterly, 2009; Saith, 2006).

To address these criticisms and to motivate progress towards global development, the UN is proposing a new set of goals, the Sustainable Development Goals (SDGs), that will use the foundation of the MDGs to create a post-2015 global development agenda (United Nations, 2015). The UN has indicated that the proposed SDGs must be action-oriented, concise, easy to communicate, limited in number, aspirational, global, and universally applicable in all countries (United Nations, 2015). The Secretary-General has also noted that key populations – especially women and children – were left behind in the "unfinished work" of the MDGs (United Nations, 2014). Based on the most recent draft of the 17 proposed SDGs, key differences between the MDGs and the SDGs include:

1. Focusing on the poorest and hardest to reach; empowering developing countries by including them in the SDG creation process;
2. Using data to monitor and evaluate countries to increase accountability; and
3. Increasing country autonomy by decreasing reliance on foreign aid and increasing own-revenue sources (Coonrod, 2014).

Until the SDGs are released, however, the MDGs remain a key focal point, and most indices of human development include measures related to at least one of the MDGs.

Alternative Indices of Human Development

The remainder of this report reviews a range of indices that are currently used to measure human development (HD) and country progress. We do not focus on assessments of country progress or indices that are not composites or do not have an explicit HD component (e.g., Corruption Perception Index, Doing Business Survey, etc.), although the analysis includes indices and tools that combine human development components and measures such as corruption and political openness.

The analysis focuses on the following research questions:

1. What measures or indices have been developed to measure HD progress?
2. What is the methodology of each measure or index, and what are the associated tradeoffs?

We assess characteristics of the selected indices, including their methodologies and components. Next, we evaluate tradeoffs across of these indices in terms of methodology, ease of calculation, ease of interpretation, coverage of different components of human development, and comparability. Finally, we consider evidence of traction for the 22 selected indices to evaluate which indices are most commonly reviewed and used. Appendix A gives a brief overview of each of the indices reviewed.

Methodology

To identify existing indices that aim to measure country progress on human development, we conducted searches on Scopus, Google, and Google Scholar. Following the initial screening, 291 relevant sources were shortlisted which discussed 120 different measures. We compiled a final list of 22 relevant human development composite indices[1], based on the criteria that the measure must be:

1. an index including indicators from multiple components of human development (e.g. health and education), rather than measuring multiple aspects within a single component of human development;[2]
2. a composite index using a method or methods of aggregation (as opposed to a dashboard measure which showcases individual indicators separately at a glance);
3. current (continues to be updated with empirical data and not specifically being replaced by another index); and
4. a calculated measure that is not merely a proposal (as reflected by discussion or adoption by organizations).

We conducted supplemental searches on each of the 22 indices to find information on strengths and weaknesses and evidence of traction (defined as the degree to which indices are broadly used to measure human development across multiple countries). In addition to these 22 human development indices, we also review GDP as an example of a measure that is not focused on human development but is nevertheless commonly used as a proxy. Table 2 summarizes key characteristics of the selected indices, including the year the index was introduced, who developed each index, the number

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[1] Appendix D provides a table of 20 other indices that measure human development in some manner, including a brief description of those indices and an explanation of the reason for exclusion from the final list of indices included in this review.

[2] For instance, an index that considers only health – even if it measures health in multiple aspects like child mortality, life expectancy, etc. – would not be included in this review. However, an index that measures both health and education would be included because of its focus on multiple components.

of indicators it aggregates, an estimation of the number of countries for which the index is calculated[3], the earliest year for which the index was calculated[4], and the frequency with which the index is calculated. The indices in Table 2 are ordered by the year in which they were introduced.

Table 2. Summary of Selected Human Development Indices

Index	Year introduced	Developed by	# of indicators	# of countries	Earliest year available	Frequency of calculation
Gross Domestic Product (GDP)	1934	Simon Kuznets	4	190	1934	Annual
Human Development Indicator (HDI)	1990	UNDP	3	187	1980	Annual
Index of Economic Freedom (IEF)	1995	The Heritage Foundation	10	186	1995	Annual
Genuine Progress Indicator (GPI)	1995	Redefining Progress	26	Not specified	1950	Not specified
African Gender and Development Index (AGDI)	2004	UN Economic Commission for Africa	3	12	2000	Every 5 years
Ease of Doing Business Index (EDBI)	2006	World Bank	10	189	2006	Annual
Global Gender Gap Index (GGI)	2006	World Economic Forum	14	142	2006	Annual
Happy Planet Index (HPI)	2006	Not specified	3	151	2006	Every 5 years
Human Asset Index (HAI)	2006	UN	4	132	2006	Every 3 years
Global Innovation Index	2007	Cornell University, INSEAD, & the World Intellectual Property Organization	81	143	2008	Annual
Legatum Prosperity Index (LPI)	2008	Legatum Institute	89	142	2008	Annual
Social Institutions and Gender Index (SIGI)	2009	OCED Development Center	14	160	2009	Published three times since 2009
Gender Inequality Index (GII)	2010	UNDP	5	187	2010	Annual
Inequality adjusted HDI (IHDI)	2010	UNDP	6	145	2010	Annual
Multidimensional Poverty Index (MPI)	2010	Oxford Poverty & Human Development Initiative (OPHI)	10	110	2010	Every 2 years
Africa Infrastructure Development Index (AIDI)	2011	African Development Bank (AfDB)	9	53	2000	Annual
Better Life Index (BLI)	2011	OECD	11	34	2011	Annual
Global Food Security Index (GFSI)	2012	The Economist Intelligence Unit	28	109	2012	Annual
Social Progress Index (SPI)	2013	Social Progress Imperative	53	133	2013	Annual
Genuine Savings	2013	World Bank	6	120	1995	Every 5 years
Gender-Related Development Index (GDI)	2014	UNDP	3	187	2014	Annual
Quality of Growth Index (QGI)	2014	IMF	6	90	1990	Published once since developed
Safe Cities Index	2015	The Economist Intelligence Unit	44	50	2015	Published once since developed

As shown in Table 2, the development of composite indices of human development has flourished in recent years, especially in the last decade. Index summary tables with descriptions and summary analyses for each of these 23 indices are included in Appendix A. Appendix B describes in greater detail the search methodology and the criteria used, including search strings and search results. Appendix C includes a list of 20 other measures that may be used as indicators of human development progress but that did not meet our inclusion criteria for this review.

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[3] Number of countries covered is based on geographical coverage in the most recent year the index was calculated. Coverage for certain indices may vary from year to year due to issues with data availability in certain countries.
[4] A number of indices have been calculated to rank countries retroactively, allowing, for example, an index that is created in the 1990s to have rankings available beginning in the 1980s or sooner.

Approaches to Index Calculation

While all selected HD measures are composite indices that include indicators from multiple components of human development, each measure has a different approach to index calculation. Appendix A tables provide greater detail on the methodologies.

Major methodological issues for calculating HD indices include selection of the number and type of indicators, normalization and aggregation of components, and comparability of indices over time. These issues and associated strengths and weaknesses are summarized in Table 3.

Table 3. Key Aspects of Human Development Index Methodology

		Definition	Strengths	Weaknesses
Number and Type of Indicators		The number of individual indicators that are being aggregated to produce one index.	An index with indicators for more components can give a more comprehensive view of human development.	Collapsing multiple indicators and components into one index can obscure the meaning, interpretation, and robustness of the index.[5]
Index Calculation	Normalization	A process to transform indicators with different units into unit-less values between 0 and 1, often by taking the ratio of an indicator to a given benchmark.	Normalization has advantages for aggregating multiple components into one index and comparability across countries.	Normalization complicates interpretation[6] and precludes comparison over time if benchmarks used to normalize vary from year to year[7].
	Aggregation	A process to combine indicators of similar or different units into an aggregate index of human development	Creates a single end score to measure human development through multiple components.	The single end score can obscure dispersion across multiple components.
Time-series Comparability		The ability for an index to track or compare changes in the human development progress in the same country over a period of time.	Consistent formula, data sources, and data collection methods need to be used over the periods under comparison.	Any structural changes to the methodology[8], changes to the component's methodology[9], or changes in data collection procedures or definitions[10] affect comparability over time.

Selecting the **number of indicators** is an important methodological decision. Each index is based on theoretical choices about the relative importance of different components of human development, including education, health, standard of living, and so on. Some authors have criticized indices like the Index of Economic Freedom and the Human Poverty Index for their choices of which components to include (de Haan & Sturm, 2000; Otoiu, et al., 2014). Indices that include indicators for more components may provide a more comprehensive view of human development, but they are also more difficult to interpret and face more challenges with data quality (Ravallion, 2011).

Once components have been selected, decisions on indicators to measure the components and on methods to aggregate them are required.

Normalization transforms index indicators with different units into consistent, often unit-less, values (e.g., normalized scores between 0 and 1) before they are aggregated, usually by calculating the ratio of the indicator to a specific benchmark. The need for normalization arises because composite indices are often composed of indicators that are measured in different units. For example, the HDI is comprised of indicators including life expectancy (in years) and standard of living (in dollars) (United Nations Development Programme, 2014a). Because these units are different, the HDI normalizes the unit for each indicator so that it becomes a single number between 0 and 1. For example, the HDI's health component is normalized by dividing the difference between a country's life expectancy and the minimum life expectancy by the difference between the maximum and minimum life expectancies as measured by the UNDP. This process enables the HDI to generate a health component score between 0 and 1 that can then be reviewed similarly to a normalized score calculated from the standard of living component, although that is originally calculated in dollars (*ibid.*).

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[5] Ravallion, 2011.
[6] Freudenberg, 2003.
[7] Neumayer, 2001.
[8] Neumayer, 2001.
[9] Banaian & Roberts, 2008.
[10] Alkire et al., 2015.

While normalization has advantages for comparability across countries and aggregating components, it also creates difficulties in interpretation, as it is not as easy to connect a normalized measure to performance in particular facets of human development (Freudenberg, 2003). Moreover, as described further below, normalization based on benchmarks that change from year to year may lead to challenges for making comparisons in index values over time (Mazziotta & Pareto, 2012).

Components can be aggregated linearly or non-linearly: A **linear index**[11] is calculated using a simple summation or a simple arithmetic mean (i.e. linear average). Linear indices have the advantage of being simple to calculate and easy to interpret, making them popular among development indices (De Muro, Mazziotta, & Pareto, 2011). A **simple summation** is the simplest approach to index calculation, with all indicator values added together to arrive at a composite score.

For the calculation of **simple means**, the indicators can be weighted equally or differently (*ibid.*). An **equally-weighted mean** implies that all the indicators are perfectly substitutable (De Muro, Mazziotta, & Pareto, 2011; Mishra & Nathan, 2013). Mishra & Nathan (2013) explain that "the perfect substitutability assumption means that a differential improvement (or increment) in one indicator at any value can be substituted or neutralized by an equal differential decline (or decrement) in another indicator at any other value." In other words, indices using an equally-weighted mean value all indicators in the index equally, thus making the index "indifferent to swapping of values" across indicators (*ibid.*). On the surface this approach appears to be neutral (bias-free), though equal weights may be theoretically inconsistent (Foster, Lopez-Calva, & Szekely, 2005). The alternative approach is to use **weighted means**, which assign different values to different indicators based on theoretical assumptions about the importance of the components. De Muro, Mazziotta, & Pareto (2011) and others argue that although a weighted mean may be more theoretically consistent because it does not assume perfect substitutability between indicators, this approach can still be criticized for arbitrary assignment of weights (Eren et al. 2014; Permanver, 2013; Pinar et al., 2013; Natoli et al., 2011; Korsakiene et al., 2011; Tokuyama & Pillarisetti, 2009; Ray, 2008; Legatum Institute, 2013).

Despite their simplicity and ease of interpretation, linear aggregation methods do not capture **dispersion** or variability among index indicators. As a result, these indices do not differentiate between countries with moderate ratings on all indicators and countries with a mixture of high and low ratings. Many authors have pointed to this limitation as a weakness of linear measures (Pinar, et al., 2013; Permanver, 2013; Legatum Institute, 2013; Ray, 2008; van Staveren, 2013; IMF, 2015). On the other hand, **non-linear aggregation methods** are designed to take into account dispersion or variability. Countries with wide variation across index indicators are therefore rated lower than countries that do equally well in each indicator. Advocates of nonlinear methods argue that accounting for variability across indicators is a useful and desirable characteristic for building composite indices of poverty and development, where it may be considered important to capture the depth and areas of poverty[12] (De Muro, Mazziotta, & Pareto, 2011). For instance, a country that performs moderately well in all HDI indicators could have a higher HDI score than a country that performs very well on two indicators and poorly on the third, if the ratings are calculated to account for severity of deprivation.

The most common non-linear approach is the exponent-based **geometric mean**. Geometric means do not allow for perfect substitutability of indicators, more heavily weighting index indicators with lower scores and penalizing uneven development (De Muro, Mazziotta, & Pareto, 2011; Mishra & Nathan, 2013). As summarized by De Muro, Mazziotta, & Pareto (2011), a geometric mean of order greater than one places greater weight on index indicators with larger deprivation, and is therefore useful for aggregating indices when deprivation on any one indicator is considered detrimental for overall development. Table 4 provides a definition for and the tradeoffs of each of these common methods of index calculation.

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[11] "A mathematical function in which the variables appear only in the first degree, are multiplied by constants, and are combined only by addition and subtraction." (Merriam-Webster Dictionary, 2015)

[12] For example, the squared poverty gap is a non-linear measure used to place a higher weight on poorer households by taking the average of the square of the distance separating households from the poverty line. This measure of poverty emphasizes severity of deprivation, so that a country with a small number of very poor households may have a lower rating than a country with a larger number of moderately poor households (The World Bank, 2015c).

Table 4. Approaches to Index Calculation

		Definition	Strengths	Weaknesses	Example[13]
Linear	Simple Summation	This method of calculation sums the indicators together and reports the summation as the final index result.	Ease of calculation and of interpretation.	Does not capture dispersion or depth of deprivation.[14]	$$Index = I_1 + I_2 + I_3$$
	Simple Mean / Linear Average (Equal Weighting)	This approach equally weights and sums up the indicators and divides the sum by the number of indicators.	Weighting each indicator equally allows for easy calculation and interpretation. Valuing all indicators equally seems to be a neutral approach.	Often criticized for its simplicity and its arbitrary weighting.[15,16,17]	$$Index = \frac{I_1 + I_2 + I_3}{3}$$ *Note: in this simple mean, all components are equally weighted.*
	Weighted Mean (Unequal weighting)	Similar to the simple mean, in this approach each indicator is weighted differently in order to denote importance or magnitude of different indicators.	Ability to account for the relative importance of indicators.[18]	Decision of how to weight indicators in a non-arbitrary way is often debated.[19]	$$Index = \frac{2I_1 + I_2 + I}{4}$$ *Note: In this weighted mean, I1 is weighted twice as much as I2 and I3.*
Non Linear	Geometric Mean	This method multiplies the indicator scores together and finds the n-root of that product.	Geometric or power means of order greater than one account for dispersion by placing greater weight on the indicators with larger deprivations.[20]	More complex to calculate than a simple summation or linear average.	$$Index = \sqrt[3]{I_1 * I_2 * I_3}$$ *Dispersion example:* $Country\ 1 = \sqrt[3]{4 * 4 * 4} = 4$ $Country\ 2 = \sqrt[3]{2 * 4 * 6} = 3.6$ Although both countries have an average indicator score of 4, the dispersion in Country 2 decreases its score.

Index calculation methodologies may affect its comparability over time. **Time-series comparability** requires that an index uses consistent formula, data sources, and data collection methods over the periods under comparison. Any structural changes to the methodology (Neumayer, 2001), changes to an indicator's methodology (Banaian & Roberts, 2008), or changes in data collection procedures or definitions (Alkire et al., 2015) may threaten an indice's comparability over time. A good example is the HDI. Since its creation in 1990, there have been several revisions to its methodology. The biggest change happened in 2010 when the HDI's aggregation method was changed to a geometric mean from arithmetic mean. The HDI has since been recalculated for previous years to reestablish time-series comparability.

Normalized indices can also preclude comparisons over time if the methods used to normalize different indicators vary from year to year (Neumayer, 2001; Klasen & Schuler, 2011; Mazziotta & Pareto, 2012). For example, the HDI relies on maximum and minimum values when normalizing its indicators (United Nations Development Programme, 2013), according to:

$$Indicator\ Score = \frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value}$$

Prior to 1994, the minimum and maximum values used were actual country data for that year (Neumayer, 2001). A country's index thus became a relative measure against realized data from a specific year, so that indices from different

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[13] I = Indicator used in index calculation
[14] Pinar, et al., 2013; Permanver, 2013; Legatum Institute, 2013: Ray, 2008
[15] Eren, et al., 2014; Permanver, 2013; Pinar, et al., 2013; de Muro, Mazziotta, & Pareto, 2011; Natoli, et al., 2011; Korsakiene, et al., 2011; Tokuyama & Pillarisetti, 2009; Ray, 2008; Legatum Institute, 2013
[16] For example, McGillivray and White (1993) analyze the HDI and determine that it is possible to exclude any of the HDI sub-dimensions and still achieve a score that is highly correlated (0.95) to the original HDI.
[17] Mcgillivray and Noorbakhsh (2004) note the following: "The three components of the HDI, for example, are assigned weights of one-third each. This in principle is almost certainly incorrect, as it implies that each component is equally important, in terms of well-being achievement, at all points of time and levels of achievement, and in all regions, countries, cultures, levels of development, and so on. The UNDP recognizes this but justifies the HDI weighting scheme on the basis of Occam's razor; that is, since it is probably impossible to achieve agreement on what the weights should be, the simplest response is the best, that being to assign an equal weight to each component."
[18] de Haan & Sturm, 2000
[19] Otoiu, et al., 2014
[20] De Muro, Mazziotta, & Pareto, 2011

years could not be meaningfully compared with each other (Neumayer, 2001). HDI calculations now use the highest values observed in the current time series (1980-2014) for the maximum value. Minimum values are set at "subsistence values" defined by the UNDP (United Nations Development Programme, 2013). But even with these revisions there remains potential for incomparability in measures over time: for example, if a new maximum score is reached on any indicator (e.g., if the average life expectancy in the top-performing country grows to over 85) or if the minimum values are changed by the UNDP, the HDI would need to be recalculated for all years in the time series in order to compare scores over time.

Characteristics of the Selected Human Development Indices

In the following sections, we review and compare the methodologies of the 22 selected indices along with GDP, and assess tradeoffs among the index's methodology, calculation, interpretation, comparability, and coverage of HD components.

Index Calculation

Table 5 includes the following methodological information: the number of individual indicators (measures of human development components) that are used to calculate the index, whether the index is linear, whether it accounts for dispersion across components, whether components are weighted equally in calculating the index, whether the index is normalized, and whether the index is comparable over time. Indices are ordered by the number of indicators they include (from smallest to largest).

Table 5. Index Methodologies in Human Development Indices

Index	Number of indicators	Linear	Accounts for dispersion	Equal weighting	Normalized	Time series comparability
Legatum Prosperity Index (LPI)	89	Yes	No	Yes	Yes	Yes
Global Innovation Index	81	Yes	No	Yes	Yes	No
Social Progress Index (SPI)	53	Yes	No	No	Yes	Yes
Safe Cities Index	44	Yes	No	Yes	Yes	No
Global Food Security Index (GFSI)	28	Yes	No	No	Yes	Yes
Genuine Progress Indicator (GPI)	26	Yes	No	Yes	No	Yes
Global Gender Gap Index (GGI)	14	Yes	Yes	Yes	No	Yes
Social Institutions and Gender Index (SIGI)	14	Yes	Yes	Yes	Yes	Yes
Better Life Index (BLI)	11	Yes	No	No	Yes	No
Index of Economic Freedom (IEF)	10	Yes	No	Yes	No	Yes
Ease of Doing Business Index (EDBI)	10	Yes	No	Yes	Yes	Yes
Multidimensional Poverty Index (MPI)	10	Yes	No	No	No	Yes
Africa Infrastructure Development Index (AIDI)	9	Yes	No	No	Yes	Yes
Inequality-Adjusted HDI (IHDI)	6	No	Yes	Yes	Yes	Yes
Genuine Savings	6	Yes	No	Yes	No	Yes
Quality of Growth Index (QGI)	6	Yes	No	Yes	Yes	Yes
Gender Inequality Index (GII)	5	No	Yes	Yes	Yes	Yes
Gross Domestic Product (GDP)	4	Yes	No	Yes	No	Yes
Human Asset Index (HAI)	4	Yes	No	Yes	Yes	No
African Gender and Development Index (AGDI)	3	Yes	No	Yes	Yes	Yes
Happy Planet Index (HPI)	3	Yes	Yes	No	No	No
Human Development Index (HDI)	3	No	Yes	Yes	Yes	Yes
Gender-Related Development Index (GDI)	3	No	Yes	Yes	Yes	No
Grand Total	-	19	7	17	16	17

As shown in Table 5, the **number of indicators** ranges from three – for the GDI, HDI, African Gender Development Index (AGDI), and the Happy Planet Index (HPI) - to as many as 89 for the Legatum Prosperity Index (LPI). In some cases, multiple indicators are used to measure the same human development components. For example, the Legatum Prosperity Index is composed of 89 indicators that are used to measure eight components: Economy, Entrepreneurship & Opportunity, Governance, Education, Health, Safety & Security, Personal Freedom, and Social Capital (Legatum Institute, 2015a).

Although an index with more indicators is often more comprehensive in terms of coverage of HD components, the meaning, interpretation, and robustness of the index often becomes ambiguous (Ravallion, 2011). Sixteen of the 23 indices **normalize** components, further complicating interpretation of any given result.

Nineteen out of the 23 measures are **linear**. Three of the 19 (GDP, Genuine Progress Indicator (GPI), Genuine Savings) use the **simple summation** method, summing the components together and reporting the total as the final index result. In general, this method is associated with greater ease of calculation and of interpretation. However, the GPI and Genuine Savings indices are sums of normalized components, resulting in numerical scores that are more difficult to interpret.

Ten other linear indices use **simple, equally-weighted means**. The remaining six linear indices (MPI, GGI, AIDI, GFSI, BLI, HPI) use a **weighted mean** to denote the relative importance of different components. For example, the default model of the Global Food Security Index (GFSI) averages the suggested weights from an expert panel for each component to reflect judgments about their relative importance.

Only four of the 23 indices (HDI, GII, GDI, and IHDI) use **non-linear approaches** involving geometric or power means, and all four use relatively few indicators (six or fewer). These four indices are the most prevalent measures of HD published by the UNDP. Their calculation approach favors countries that are doing relatively well in all aspects of human development, and magnifies the weaknesses of countries that perform poorly on any given subcategory.

Lastly, **time series comparability**, indicating whether indices can be used to compare performance over time, is possible for nearly three quarters of the indices (17 out of 23). In some cases, comparison over time is not possible because indices are new, or because indices changed their formulas at some point and have not been recalculated for previous years, limiting the period of comparability (e.g., Gender Inequality Index, Gender-Related Development Index, Human Asset Index). These indices could be compared over time if consistent time series data were used. Some indices, however, such as the Global Food Security Index, are calculated using benchmarks that change each year, making comparison over time impossible.

Coverage of Human Development Components

As illustrated by Sen's capabilities theory and the UN's development of the MDGs, HD cannot be measured by a single development indicator. The UN's MDGs present six components of HD that indices might incorporate: standard of living, education, gender equality, health, environmental sustainability, and social development and governance. Although this is not a comprehensive list of HD components, we analyze whether the indices we review include measures that relate to the different MDGs. As shown in Table 6 (sorted by number of MDGs covered), we find that all of the 23 indices reviewed include measures that relate to at least one of the MDG subject areas (e.g., some measure of education, but not necessarily universal primary education). Five indices appear somewhat specialized, only including indicators related to one of the MDGs. The LPI appears most highly related to the MDGs, with six of the eight MDG subject areas covered, followed by the BLI and AGDI both covering five MDG subject areas.

Table 6. Coverage of MDGs in Human Development Indices

Human Development Component:	Standard of Living	Education	Gender Equality	Health: Reduce Child Mortality	Health: Improve Maternal Health	Health: Combat Diseases	Environmental Sustainability	Social Development and Governance	
Index	MDG 1	MDG 2	MDG 3	MDG 4	MDG 5	MDG 6	MDG 7	MDG 8	Total
Legatum Prosperity Index (LPI)	Yes	Yes		Yes		Yes	Yes	Yes	6
African Gender and Development Index (AGDI)	Yes	Yes	Yes	Yes				Yes	5
Better Life Index (BLI)	Yes	Yes	Yes				Yes	Yes	5
Multidimensional Poverty Index (MPI)	Yes	Yes		Yes			Yes		4
Social Progress Index (SPI)		Yes		Yes	Yes		Yes		4
Genuine Progress Indicator (GPI)	Yes	Yes					Yes		3

Index									Total
Global Gender Gap Index (GGI)		Yes	Yes					Yes	3
Human Asset Index (HAI)	Yes	Yes		Yes					3
Global Innovation Index		Yes					Yes	Yes	3
Gender Inequality Index (GII)		Yes	Yes		Yes				3
Genuine Savings	Yes	Yes					Yes		3
Gender-Related Development Index (GDI)	Yes	Yes	Yes						3
Quality of Growth Index (QGI)	Yes	Yes		Yes					3
Safe Cities Index				Yes	Yes		Yes		3
Human Development Index (HDI)	Yes	Yes							2
Inequality-Adjusted HDI (IHDI)	Yes	Yes							2
Global Food Security Index (GFSI)	Yes							Yes	2
Gross Domestic Product (GDP)	Yes								1
Index of Economic Freedom (IEF)								Yes	1
Ease of Doing Business Index (EDBI)								Yes	1
Happy Planet Index (HPI)							Yes		1
Social Institutions and Gender Index (SIGI)			Yes						1
Africa Infrastructure Development Index (AIDI)						Yes			1
Grand Total	**13**	**15**	**6**	**7**	**3**	**2**	**9**	**8**	

The most commonly measured MDG component is education, with 15 of the 23 indices including an indicator that reflects the importance MDG 2 places on formal education, knowledge acquirement, and literacy. Thirteen indices include measures related to poverty and hunger, which we categorize with measures of standard of living. Nine indices consider at least one of the specific health indicators included in the MDGs, though some indices have other health-related components.

Since the MDGs are only one set of measures attempting to track progress in human development, we further compare the various indices according to an alternative HD framework. A review of definitions of HD used by several development organizations and nonprofits, including the Organization for Economic Cooperation and Development (OECD), United Nations Development Programme (UNDP), Oxford Poverty and Human Development Initiative (OPHI), World Bank, and Oxfam International revealed that these organizations define human development by progress in either:
1. human capacity (measured by health, education, and standards of living using various economic indicators[21]);
2. environments for human development (measured by income equality[22], gender equality, environmental sustainability, political freedom and process freedom, and social development and governance[23]); or
3. both of these dimensions.

The first dimension, human capacity, focuses on the outcomes of human development: a healthy, educated population with basic needs met. This dimension is based on Sen's capabilities approach, as a number of key indices have been built on the theory (Sen, 1984). Sen argues that the three components of human capacities – education, health, and standard of living – lead to a developed society, even if other development dimensions are not present (*ibid.*). These three components are reflected in MDGs 1, 2, 4, 5, and 6.

The second dimension, supportive environments for HD, focuses on the means that are beneficial for achieving the human capacity outcomes. These factors include income equality, gender equality, environmental sustainability, political freedom & process freedom, and social development and governance. The gender equality component is reflected in MDG 3, while MDG 7 relates to environmental sustainability and MDG 8 to social development and governance. The additional components of income equality and political freedom and process freedom are included to account for the aspects of HD that have been identified as important by international organizations like the UNDP, OPHI, the World Bank, and Oxfam, yet were not incorporated in the MDGs. The proposals for the new SDGs, which will replace the MDGs, appear to include goals related to these sub-dimensions.

Fifteen of the indices cover aspects of both dimensions of human development (*Figure 1*). For example, the Social Progress Index (SPI) includes indicators that measure environmental sustainability, political freedom, and social development in addition to indicators that measure education and health outcomes directly. Seven of the 22 indices (excluding GDP) are

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[21] Standard of living is defined as an economic measure of development. In the case of the HDI, standard of living is determined by gross national income per capita (United Nations Development Programme, 2014a).
[22] While standard of living reflects a country's economic measure or development, an index measuring income equality will account for the income distribution among a country's citizens (United Nations Development Programme, 2014a).
[23] Social development and governance reflects a country's ability to provide infrastructure and welfare institutions for its population.

comprised of indicators that measure either expanding human capabilities (four indices: MPI, HAI, HDI, and QGI) or creating supportive environments (three indices: SIGI, AIDI, and EDBI). For example, the Human Development Index (HDI), one of the most influential indicators of human development, measures human capabilities through health, education, and standard of living, but does not consider components that are classified under creating supportive environments.

Figure 1. Indices and Human Development Dimensions
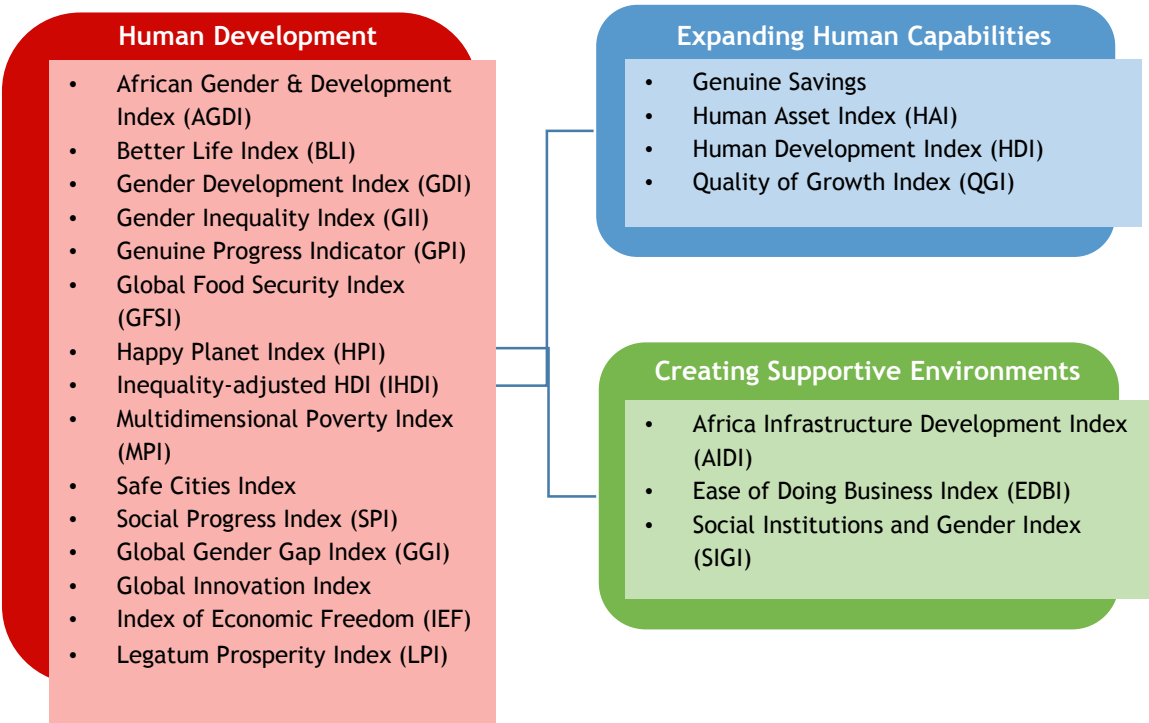
In addition to distinguishing these two dimensions of HD, the definitions of HD that we review also include eight components that fall under these two dimensions. Table 7 presents which HD components are covered by the indices, sorted by number of components covered. The Better Life Index (BLI) and GGI cover the most, including measures from seven out of eight components. The LPI and AGDI cover six components, and the SPI and GII both cover five. The African Infrastructure Development Index (AIDI), GDP, and Ease of Doing Business Index are the only indices that cover only one component.

Table 7. Coverage of Human Development Components in Human Development Indices

Human Development Dimension:	Expanding Human Capabilities			Creating Supportive Environments for Human Development					
Human Development Component:	Education	Health	Standard of living	Income equality	Gender equality	Environmental Sustainability	Political freedom & process freedom	Social development & governance	Total
Global Gender Gap Index (GGI)	Yes	Yes	Yes	Yes	Yes		Yes	Yes	7
Better Life Index (BLI)	Yes	Yes	Yes		Yes	Yes	Yes	Yes	7
African Gender and Development Index (AGDI)	Yes	Yes	Yes		Yes		Yes	Yes	6
Legatum Prosperity Index (LPI)	Yes	Yes	Yes			Yes	Yes	Yes	6
Gender Inequality Index (GII)	Yes	Yes			Yes		Yes	Yes	5

Index	C1	C2	C3	C4	C5	C6	C7	C8	Total
Social Progress Index (SPI)	Yes	Yes				Yes	Yes	Yes	5
Global Innovation Index	Yes					Yes	Yes	Yes	4
Inequality-Adjusted HDI (IHDI)	Yes	Yes	Yes	Yes					4
Global Food Security Index (GFSI)		Yes	Yes	Yes				Yes	4
Gender-Related Development Index (GDI)	Yes	Yes	Yes		Yes				4
Human Development Index (HDI)	Yes	Yes	Yes						3
Genuine Progress Indicator (GPI)			Yes			Yes		Yes	3
Index of Economic Freedom (IEF)			Yes				Yes	Yes	3
Multidimensional Poverty Index (MPI)	Yes	Yes	Yes						3
Genuine Savings	Yes		Yes			Yes			3
Quality of Growth Index (QGI)	Yes	Yes	Yes						3
Safe Cities Index		Yes				Yes		Yes	3
Happy Planet Index (HPI)		Yes				Yes			2
Human Asset Index (HAI)	Yes	Yes							2
Social Institutions and Gender Index (SIGI)					Yes			Yes	2
Gross Domestic Product (GDP)			Yes						1
Ease of Doing Business Index (EDBI)								Yes	1
Africa Infrastructure Development Index (AIDI)								Yes	1
Grand Total – Components	14	15	14	3	6	8	8	14	-
Grand Total – Dimensions		19				18			

The most popular components covered by the indices are health (covered in 14 indices), education (13), social development and governance (13), and standard of living (12). This focus is in accordance with the UN's initial definition of human development that focused on health, education, and standards of living (United Nations Development Programme, 1990).

While the coverage of HD dimensions as mapped against the MDGs and against our HD framework is similar, one apparent discrepancy between the results shown in Tables 6 and 7 is in the area of health. Table 7 shows that health indicators are the most commonly incorporated measures for the indices we review. In contrast, in Table 6's overview of the indices' coverage of the MDGs, health appears to be the least-measured subject area. This difference is because health has a very widespread presence in the MDGs, which includes three specific health issues as reflected by MDG 4 – *reduce child mortality*, MDG 5 – *improve maternal health*, and MDG 6 – *combat HIV/AIDS, malaria, and other diseases*. Therefore, while a majority of the indices (14 out of 22 as shown in Table 7) include some kind of overall health indicator, only eight of them include indicators that map directly onto the three MDG health foci: maternal health (usually seen in gender indices), child mortality, and HIV/AIDS and other diseases. The other six indices that include health-related indicators measure different aspects of health (e.g., life expectancy, nutrition, self-reported health, sex ratio at birth, level of worrying, etc.) not covered by the MDGs.

Tradeoffs across All Indices

As a final step we evaluate the 23 human development indices reviewed across five criteria that can be considered to contribute to an index's ability to gain traction among users, including: methodology, ease of calculation, ease of interpretation, coverage of different components of human development, and comparability. We would expect indices that are easier to calculate, interpret, and compare and that cover more HD components to be more likely to gain traction with most user groups, though different users will have their own criteria for index selection. Table 8 summarizes our analysis of each of the 23 indices against these criteria, sorted by methodology and ease of calculation.

The column on methodology presents the index's approach to aggregating its components. The previous section on approaches to index calculation outlines the relative strengths and weaknesses of different methodologies. In general, more complex approaches are more sensitive to weighting and dispersion of components, but are more difficult to calculate and interpret. For ease of calculation, simple summation and simple mean are rated "high," weighted mean is rated "medium," and geometric mean and simple means with additional analyses are rated "low." For ease of interpretation, we consider how easily an isolated index score can be understood. Indices with accompanying units, such as GDP and GPI which are presented in monetary terms, are rated "high" as the index clearly states what is being measured. Normalized indices with high ease of calculation are rated "medium," as although they have no units it is possible to refer to the calculation to infer what is being presented. Normalized indices with lower ease of calculation are rated "low."

We also rate the indices for coverage of HD components, based on the relation of index components to the MDGs. Indices with indicators that cover one MDG are rated "low," those that cover two MDGs are rated "medium," and those that cover three or more MDGs are rated "high." Ease of comparability is rated based on normalization and comparability over time, with indices that are normalized and comparable over time rated higher.

Table 8. Human Development Index Characteristics

Index	Methodology	Ease of Calculation	Ease of Interpretation	Coverage of MDG Components	Ease of Comparability
Index of Economic Freedom (IEF)	Simple Mean	High	High	Low	High
African Gender and Development Index (AGDI)	Simple Mean	High	Medium	High	High
Human Asset Index (HAI)	Simple Mean	High	Medium	High	Medium
Ease of Doing Business Index (EDBI)	Simple Mean	High	Medium	Low	High
Global Innovation Index	Simple Mean	High	Medium	High	Medium
The Legatum Prosperity Index (LPI)	Simple Mean	High	Medium	High	High
Safe Cities Index	Simple Mean	High	Medium	High	Medium
Happy Planet Index (HPI)	Simple Ratio	High	High	Low	Medium
Gross Domestic Product (GDP)	Simple Summation	High	High	Low	High
Genuine Progress Indicator (GPI)	Simple Summation	High	High	High	Medium
Adjusted Net Savings (Genuine Savings)	Simple summation	High	High	High	High
Global Gender Gap Index (GGI)	Simple and Weighted Mean	Medium	High	High	High
Better Life Index (BLI)	Simple or Weighted Mean[24]	Medium	Low	High	Medium
Africa Infrastructure Development Index (AIDI)	Weighted Mean	Medium	Low	Low	High
Global Food Security Index (GFSI)	Weighted Mean	Medium	Low	Medium	High
Human Development Index (HDI)	Geometric Mean	Low	Low	High[25]	High
Gender Inequality Index (GII)	Geometric Mean	Low	Low	High	High
Inequality-Adjusted HDI (IHDI)	Geometric Mean	Low	Low	High[26]	High
Gender Development Index (GDI)	Geometric Mean Ratio	Low	Low	High	Medium
Quality of Growth Index (QGI)	Simple and Geometric Means	Low	Low	High	High
Social Progress Index (SPI)	Simple Mean with Factor Analysis	Low	Low	High	High
Social Institutions and Gender Index (SIGI)	Simple Mean with Principal Component Analysis	Low	Low	Low	High
Multidimensional Poverty Index (MPI)	Sum of Deprivations[27]	Low	High	High	Medium[28]

Aspects of methodology include weighting, linearity, benchmarks and normalization, chosen components, data quality, and consistency of calculation. Tradeoffs related to the first four aspects – weighting, linearity, benchmarks/normalization, and chosen components - are discussed in depth in the section on approaches to index calculation and are presented in Tables 3 and 4. We summarize these tradeoffs in Table 8 by considering how methodological choices affect the ease of calculation, interpretation, and comparability, as well as coverage of HD components.

High ratings for all four of these criteria do not, however, imply that an index is necessarily more likely to gain traction with different user groups. A number of indices are used only by analysts and researchers (rather than by policymakers or international organizations) due to their complexity and (albeit robust) expertise-intensive methodologies. A number of new indices – responding to criticisms of lack of depth in existing indices – now take into account depth of development. For example, the MPI was created because the HDI did not measure the intensity of poverty (Alkire, 2010). The MPI was also specifically created to improve upon the UN's Human Poverty Index (HPI), which did not measure deprivations at the household level. Indices with more complex methodologies have advantages in terms of their coverage of multiple

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[24] The Better Life Index is automated to weight all sub-components equally, but is designed to allow for subjective weighting created by the user (OECD, 2014).
[25] HDI is rated "high" because although it does not include measures specifically related to the three health MDGs, it does include a measure of health.
[26] IHDI is rated "high" because although it does not include measures specifically related to the three health MDGs, it does include a measure of health.
[27] See Table A.4 in Appendix A for more details on the methodology of the MPI.
[28] MPI scores are based on publicly available data and cover various years between 2002 and 2011, which limits direct cross-country comparability (Oxford Poverty & Human Development Initiative, n.d.).

components of human development and their attention to weighting and dispersion of index components, but this also makes them more difficult to compute and interpret. As a result, while many analysts and researchers may find these indices useful, they may be less helpful for politicians, NGOs, and government officials. Some authors therefore argue that complex indices like the Gender Inequality Index and the Global Food Security Index are not especially useful (Branisa et al., 2014; Pangaribowo et al., 2013). Further, even those indices specifically designed to improve on existing indices may not gain traction until enough time has passed for them to be evaluated and to build a consistent data series.

Beyond ease of calculation, interpretation, and comparability, users may also evaluate indices according to their coverage of HD components. While global development is entering a new era of post-2015 agenda, the MDGs continue to be an important set of HD measures. They will be the foundation of the development of the new SDGs, which are intended as global targets for achieving human development (United Nations, 2015). The components of HD represented by the MDGs are therefore a useful basis for comparing the coverage of composite HD indices. Composite indices are valuable communication and political tools due to their ability to integrate large amounts of information into relatively, easily understood formats (Freudenberg, 2003). Human development composite indices that include indicators that are related to the MDGs may therefore be more helpful in informing development progress in a concise and easy to communicate manner.

As previously highlighted in Table 6, not all indices map closely onto the MDGs. For instance, while eight out of the MPI's ten indicators relate directly to MDG targets, other indices like the Ease of Doing Business Index only relate to one MDG. These indices may be criticized for having too narrow a focus within human development. Broad coverage of different components of human development is, however, less important than coverage of specific components of interest to the particular audiences using each index.

As a result of these tradeoffs, human development indices may be most effective and useful when complemented by other indices rather than considered independently. For instance, the Human Asset Index focuses on the outputs of a country, and therefore often complements the MPI or HDI well, which are both focused on inputs (Markova, 2013). The Social Progress Index, a new index, was created in order to complement GDP over time (Porter, et al., 2015). Users may choose to review multiple indices that consider different components of human development, or may consider indices that measure similar components but with different methodologies.

Three other aspects of index calculation are not presented in Table 8: data quality, calculation consistency, and geographical focus. Because of the nature of international data, all indices face issues with data quality and reliability. Data for governments and for development organizations are gathered locally and then aggregated to measure country-wide growth. Several authors have noted that national data are often political, and may contain errors due to data updating, formula revisions, and country thresholds that change each year (Jervon, 2013; Wolff, et al., 2011; Tokuyama & Pillarisetti, 2009; Stanton, 2007). The lack of validity and reliability of state-level data therefore weakens the validity and reliability of the national and international data presented in composite indices (Jerven, 2013). Appendix D on data availability and quality provides an illustration of how data quality issues can lead to differences in measures or rankings using the example of GDP.

Indices may also be evaluated according to whether they are calculated consistently from year to year. The Better Life Index allows anyone interested to personalize its methodology by applying different indicator weights. This personalization allows individual users to make their own decisions about the relative importance of difference dimensions of human development, but creates challenges for comparing across time or countries. While this index is popular among the media and citizens, it is not used by governments or international organizations for this reason (OECD, 2014). Other indices, notably the HDI, also change how they are calculated over time (United Nations Development Programme, 2014a). Indices whose methodology changes over time are more difficult to interpret and less useful for comparison, unless they are recalculated for previous years after each methodology change.

Another feature of indices that may affect their relevance to different users is focus on certain geographic areas. This criterion is discussed in the specific index summary tables in Appendix A. For example, the African Infrastructure and Development Index and the African Gender and Development Index are Africa-centric, allowing for better measurement within Africa but not accounting for other developing nations. On the other hand, the Better Life Index only measures human development across the 34 OECD member nations, and therefore ignores developing countries altogether (OECD, 2014). Indices that measured human development in only one country, such as Gross National Happiness in Bhutan, were

not included in this report due to their inability to make cross-country comparisons, but may also be used to measure human development.

Index Traction

Having reviewed the tradeoffs among the 22 human development composite indices, along with GDP, we evaluate whether these indices have gained any traction. In *Table 9*, we rate the indices according to four criteria for traction – or evidence of actual relevance and use:

(1) number of countries for which the index is calculated;
(2) frequency of calculation;
(3) frequent discussion in the academic and grey literature; and
(4) use by governments, researchers, media, private businesses, international organizations, and nonprofits.

Table 9. Traction of Selected Human Development Indices

Index	Number of countries for which index is calculated	Frequency of calculation	Frequent discussion and testing in academic and grey literature	Use by governments, researchers, media, private businesses, and nonprofits	Year Introduced
Gross Domestic Product (GDP)	190	Annual	High	High	1934
Ease of Doing Business Index (EDBI)	189	Annual	Low	High	2006
Human Development Index (HDI)	187	Annual	High	High	1990
Gender Inequality Index (GII)	187	Annual	Medium	High	2010
Gender-Related Development Index (GDI)	187	Annual	High	High	2014
Index of Economic Freedom (IEF)	186	Annual	Low	High	1995
Social Institutions and Gender Index (SIGI)	160	Every 2 years	Low	Medium	2009
Happy Planet Index (HPI)	151	Every 5 years	Medium	Medium	2006
Inequality-Adjusted HDI (IHDI)	145	Annual	Medium	High	2010
Global Innovation Index	143	Annual	Low	Medium	2007
Global Gender Gap Index (GGI)	142	Annual	Low	Medium	2006
Legatum Prosperity Index (LPI)	142	Annual	Low	High	2008
Social Progress Index (SPI)	133	Annual	High	Medium	2013
Human Asset Index (HAI)	132	Every 3 years	Low	Low	2006
Genuine Savings	120	Every 5 years	Low	Medium	2013
Multidimensional Poverty Index (MPI)	110	Every 2 years	High	High	2010
Global Food Security Index (GFSI)	109	Annual	Low	High	2012
Quality of Growth Index (QGI)	90	Published once since developed	Low	Low	2014
Africa Infrastructure Development Index (AIDI)	53	Annual	Low	Medium	2011
Safe Cities Index	50	Published once since developed	Low	Low	2015
Better Life Index (BLI)	34	Annual	Low	Medium	2011
African Gender and Development Index (AGDI)	12	Every 5 years	Low	Medium	2004
Genuine Progress Indicator (GPI)	Not specified	Not specified	Medium	Medium	1995

Table 9 includes the actual number of countries for which each index is calculated, as well as the frequency with which they are calculated. We also rate each index based on the frequency of its discussion in academic and grey literature, which is determined by the amount of literature found during our literature search. The academic articles identified in our search include mentions of more than half of the 22 indices, but only GDI, GPI, MPI, and HDI are discussed in more than two different academic sources. Each of these four indices is discussed in more than five of the academic sources we reviewed. To assess more broad-based traction, we add mentions in academic sources to mentions in grey literature such as white papers, articles from the media, and organizational reports. Indices discussed in at least ten academic or grey sources are

rated as "high," indices discussed in between five and nine pieces of literature are rated as "medium," and indices discussed in fewer than five articles are rated as "low." Finally, we rate the indices on use by governments, researchers, media, private businesses, international organizations, and nonprofits as identified during the initial literature search. Indices used by only one field of users (for instance: researchers, or nonprofits) are rated "low," those that are used by two fields of users are rated "medium," and those used by users from at least three different fields are rated "high."

According to our criteria, GDP, the HDI, the Multidimensional Poverty Index (MPI), and the Gender Development Index (GDI) are the only indices with high levels of discussion and testing as well as use by different groups. If we also consider frequency of measurement and number of countries included, GDP and the HDI stand out as the indices with the highest traction. This finding is not surprising as these were the first indices introduced, but the GDI has gained significant traction in spite of its recent introduction. Other indices which have gained traction in terms of discussion, testing, and use include the Genuine Progress Indicator (GPI), Happy Planet Index (HPI), Gender Inequality Index (GII), Inequality-adjusted HDI (IHDI), Better Life Index (BLI), and Social Progress Index (SPI). Of these ten indices that appear more widely discussed and used, five (HDI, MPI, GDI, GII, and IHDI) are published by the United Nations Development Programme (UNDP).

In many cases, such as the African Gender and Development Index (AGDI), Ease of Doing Business Index (EDBI), Global Gender Gap Index (GGI), Global Innovation Index, Legatum Prosperity Index (LPI), African Infrastructure Development Index (AIDI), Global Food Security Index (GFSI), and Genuine Savings, indices have gained traction in terms of use by different groups, but have been subjected to less academic discussion and testing.

The novelty of an index can be a weakness in terms of traction. Since the development of the HDI in 1990, there have been a number of new indices created. While the selected human development indices were all developed after 1990, 11 of the 22 indices were developed in 2010 or later, suggesting that there is increasing interest in measuring human development. The novelty of these indices by definition indicates that they have not had as much time to receive attention and to garner support or receive criticism, or to establish a data series for comparisons over time. The increasing number of indices, however, provides a larger sampling for development organizations and researchers to determine strengths and weaknesses that may improve current and future indices, and to understand what characteristics are most relevant to different user groups.

Conclusion

Since the creation of the HDI in 1990 based on Sen's Capabilities Approach, numerous other composite indices have emerged in an attempt to replace or supplement GDP in measuring human development. We identified 22 composite development indices that meet the following criteria: 1) incorporating measures of multiple components of human development; 2) aggregating multiple components into a single composite index; 3) continued use; and 4) discussion or adoption by organizations or people beyond the author.

We review the indicators used to calculate each index and map them against components of human development included in the definitions of major international development organizations. We find that the most common components of human development covered by the indices are health (covered in 14 indices), education (13), social development and governance (13), and standard of living (12). Components relating to creating a supporting environment, such as income equality, gender equality, and environmental sustainability, are less common overall, but are increasingly used in more recent indices.

As a result of their unique characteristics and construction methodologies, each human development index has its own strengths and weaknesses that affect their relevance to users. Indices with more complex methodologies can be more difficult to calculate and interpret, but may have value for development researchers looking for more nuanced measures. Indices that include a greater number of indicators may be more difficult to compare but may be useful as quick multi-faceted measure of human development. Indices with simpler methodological approaches appear to benefit from greater ease of calculation, interpretation, and comparison, but might be criticized for aggregating diverse indicators or for arbitrary weighting of components.

Some critics of composite indices argue that individual index scores may be insufficient measures to guide policy (Ravallion, 2011) as they may mask information about progress or gaps in specific aspects of human development. Using a combination

of indices provides a more comprehensive view of human development. A dashboard approach showcasing individual indicators separately can also be an alternative which can fill this gap (*Ibid.*). For example, while the HDI, HAI and MPI all include education indicators, the HDI measures education attainment through mean and expected years of schooling, the HAI looks at school enrolment ratios and the MPI measures both (Markova, 2013). In addition, the three indices also measure health differently. The HDI looks at life expectancy at birth, but the MPI and HAI both include infant mortality rates (*Ibid.*). These three indices also have different methodological approaches, as the MPI is calculated as the sum of deprivations across its sub-components while the HAI is a simple mean and the HDI is a geometric mean. Reviewing these indices together can therefore provide a more nuanced view of human development progress.

Currently, only GDP, the HDI, the Multidimensional Poverty Index (MPI), and the Gender Development Index (GDI) stand out as indices with high levels traction. These four indices are frequently discussed and tested and are used by many different groups, including governments, the media, and development researchers and practitioners. However, several other indices have achieved some traction, including the Genuine Progress Indicator (GPI), Happy Planet Index (HPI), Gender Inequality Index (GII), Inequality-adjusted HDI (IHDI), Better Life Index (BLI), and Social Progress Index (SPI). As many of the indices we review were developed in the last five years, we might expect to see several of them gain traction over time.

Because of the multidimensionality of the concept of human well-being, measuring a country's progress of human development can be a complex task. Composite indices of human development represent useful supplements to the income-based development indicators that are often used to measure human development progress (Booysen, 2002). Furthermore, their ability to simplify complex measurement constructs is also helpful for catching the eye and focusing attention (*Ibid.*), making composite indices potentially useful communication and political tools.

Please direct comments or questions about this research to Principal Investigator Leigh Anderson at eparx@u.washington.edu.

Appendix A: Index Summaries

Table A.1. Gross Domestic Product (GDP)

<table>
<tr><td colspan="2" align="center">Gross Domestic Product (GDP)</td></tr>
<tr><td colspan="2">Gross Domestic Product (GDP) is the value of expenditures on final goods and services, with imports subtracted from the final calculation.[29] Many organizations and countries use GDP to measure economic growth. GDP is often used to compare country growth by using GDP per capita PPP, a measure that converts GDP to international dollars using purchasing power parity rates.</td></tr>
<tr><td>Methodology:</td><td>GDP is the final value of all goods and services produced in a given region.[30] It can be measured using one of three ways: the expenditure approach, the production approach, and the income approach.[31] In theory, all three approaches should generate the same level of GDP.[32]</td></tr>
<tr><td>Formula:</td><td>There are three possible formulas used for calculating GDP:
Expenditures Approach: GDP = C + I + G + (X-M), where C = personal consumption expenditures, I = business investments, G = government expenditures, X = exports and M = imports.[33]
Production Approach: GDP = total output – intermediary consumption + taxes on products and imports – subsidies on products.[34]
Income Approach: GDP = employment income + mixed income (self employment) + total profit received by companies + taxes on production and imports – subsidies on production and imports.[35]</td></tr>
<tr><td>Method of aggregation:</td><td>Simple Summation</td></tr>
<tr><td>Range and interpretation:</td><td>N/A</td></tr>
<tr><td colspan="2">Components:

</td></tr>
</table>

[29] OECD, 2015.
[30] *Ibid.*
[31] GEOSTAT, 1993.
[32] *Ibid.*
[33] *Ibid.*
[34] *Ibid.*
[35] OECD, 2015.

Key Human development components included:		
Expanding Human Capabilities:	Standard of Living	
Creating Supportive Environments for Human Development:	N/A	
Data used:	Data comes from country governments and international organizations.[36] [37]	
Produced by:	World Bank, OECD, country governments, etc.[38] [39]	
Used by:	Governments, media, academics, private businesses and nonprofits	
Link:	http://data.worldbank.org/indicator/NY.GDP.MKTP.CD https://data.oecd.org/gdp/gross-domestic-product-gdp.htm	
Geographical Coverage:	Over 190 countries[40]	
MDGs coverage:	MDG 1	
Developed in year:	1934[41]	Available for time-series:	1820-2015[42]
Time-series comparability:	Yes	Frequency of measurement:	Annually, though it varies

Evaluation of the index – ease of interpretation :	
Number of indicators	4
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	No
Equal weighting	Yes

Other Strengths:
- GDP has been widely used as an indicator to measure a country's growth over time and to compare economic growth among countries.[43] [44]

Other Weaknesses:
- GDP does not accurately account for other major indicators of human development.[45] [46] [47] [48]
- The well-being of people with similar incomes in different countries might have different levels of support for health and education, which would not be accounted for.[49]
- The data used for GDP are only reliable to a certain degree.[50]

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[36] The World Bank, 2015a.
[37] OECD, 2015.
[38] The World Bank, 2015a.
[39] *Ibid.*
[40] Kuznets, 1934.
[41] World Economics, 2015.
[42] Ray, 2014.
[43] Porter, 2014.
[44] Natoli & Zuhair, 2011.
[45] Perrons, 2012.
[46] Harvard University Press, 2011.
[47] Farhat Kassab, 2014.
[48] Perrons, 2012.
[49] Menkhoff & Luchters, 2000.
[50] Jerven, 2013.

Table A.2. Gender Inequality Index (GII)

Gender Inequality Index (GII)	
The Gender Inequality Index (GII) is designed to measure gender-based disadvantages across three components: reproductive health, empowerment, and the labor market.[51] A score of 0 represents a perfectly equal society, while a score of 1 represents a perfectly unequal society.[52] The GII was created in 2010 and has since been calculated each year for over 180 countries.[53]	
Methodology[54]:	The GII is calculated using the following data: maternal mortality rate, adolescent fertility rate, share of parliamentary seats held by each sex, attainment at secondary and high education levels, and labor market participation. The index then uses geometric means calculated across all indicators and aggregates them using a harmonic mean across genders.
Formula:	$$1 - \frac{HARM(G_F, G_M)}{G_{F,M}}$$
Method of aggregation:	Geometric Means and Harmonic Mean (HARM)
Range and interpretation:	The Gender Inequality Index can range from zero to one. A GII of 0 indicates perfect gender equality, while a GII of 1 indicates perfect gender inequality.
Components:	
Key Human development components included:	
Expanding Human Capabilities:	Health, Education
Creating Supportive Environments for Human Development:	Gender Equality, Political Freedom, Social Development & Governance
Data used:	Data from international agencies and other credible data sources. Data availability is a key determinant in country coverage.[55]
Produced by:	The United Nations Development Programme[56]
Used by:	Governments, media, academics, private businesses and nonprofits
Link:	http://hdr.undp.org/en/content/gender-inequality-index-gii

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[51] United Nations Development Programme, 2013a.
[52] United Nations Development Programme, 2013b.
[53] *Ibid.*
[54] *Ibid.*
[55] United Nations Development Programme, 2014b.
[56] *Ibid.*

Geographical Coverage:	187 Countries[57]		
MDGs coverage:	MDG 2, 3, 5		
Developed in year:	2010	Available for time-series:	2010-2014[58]
Time-series comparability:	Yes	Frequency of measurement:	Annually

Evaluation of the index – ease of interpretation:

Number of indicators	5
Linear	No
Calculates dispersion/variability across indicators	Yes
Normalized	Yes
Equal weighting	Yes

Other Strengths:
- The GII replaces the older and more controversial Gender Related Development Index and the Gender Empowerment Measure.[59]

Other Weaknesses:
- The index is highly complex, very hard to interpret and communicate in any detail to policy makers.[60]

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[57] United Nations Development Programme, 2014c.
[58] United Nations Development Programme, 2014b.
[59] Wiser et al., 2015.
[60] Klasen, 2014.

Table A.3. Gender Development Index

Gender Development Index (GDI) [61]

The Gender Development Index (GDI) was created in 2014 as a simple measurement of gender development. The GDI measures the gender gap in health, education, and command over economic resources across different countries by calculating the ratio of a country's HDI of females to its HDI of males. A GDI of 1 indicates perfect gender equality, while a GDI farther from 1 (either above or below) indicates increasing gender inequality.

Methodology[62]:	The GDI is calculated by measuring the female-only HDI of a country and the male-only HDI of a country. The GDI is then simply the ratio of the female HDI to the male HDI.
Formula:	$$\frac{Female\ HDI}{Male\ HDI}$$
Method of aggregation:	HDIs are calculated using geometric means, while the GDI is calculated as a ratio of the two HDIs.
Range and interpretation:	The Gender Development Index can range from zero to two. A GDI of 1 indicates perfect gender equality, while a GDI of 0 or 2 indicates perfect gender inequality. A GDI of 0 indicates the females face perfect inequality, while a GDI of 2 indicates that males face perfect inequality.

Components:

Key Human Development components included:

Expanding Human Capabilities:	Health, Education, Standard of Living
Creating Supportive Environments for Human Development:	Gender Equality
Data used:	Data from international agencies and other credible data sources. Data availability is a key determinant in country coverage.[63]
Produced by:	The United Nations Development Programme [64]
Used by:	Governments, media, academics, private businesses and nonprofits
Link:	http://hdr.undp.org/en/content/gender-development-index-gdi
Geographical Coverage:	187 Countries [65]
MDGs coverage:	MDG 1, 2, 3

Developed in year:	2014	**Available for time-series:**	2013[66]

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[61] United Nations Development Programme, 2014d.
[62] *Ibid.*
[63] United Nations Development Programme, 2014b.
[64] United Nations Development Programme, 2013b.
[65] United Nations Development Programme, 2014d.
[66] *Ibid.*

Time-series comparability:	No (New)	Frequency of measurement:	Annually

Evaluation of the index – ease of interpretation:

Number of indicators	3
Linear	No
Calculates dispersion/variability across indicators	Yes
Normalized	Yes
Equal weighting	Yes

Other Strengths:
- The GDI is simple and sensible.[67]
- High GDI values (greater than 1) can stem from the poor human development performance of men.[68]

Other Weaknesses:
- New Index
- Difficult to interpret: It is not the country that has the highest GDI that is ranked 1st, but the country whose GDI is closest to 1, indicating perfect gender equality.[69]

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[67] Klasen, 2014
[68] *Ibid.*
[69] *Ibid.*

Table A.4. Multidimensional Poverty Index (MPI)

Multidimensional Poverty Index (MPI) [70]	
The Multidimensional Poverty Index (MPI), published for the first time in the United Nations Development Programme's Human Development Report 2010, aims to measure overlapping deprivations suffered by people at the same time. Complementing monetary measures of poverty, the index shows the number of people who are multi-dimensionally poor and the number of deprivations with which poor households typically contend with. It can be deconstructed by region, ethnicity and other groupings as well as by dimension. Because of its decomposability, the MPI can help the effective allocation of resources by making possible the targeting of those with the greatest intensity of poverty, thus making it an apt tool for policymakers. The MPI identifies deprivations across the same three dimensions as the HDI and it can help address MDGs strategically and monitor impacts of policy intervention.	
Methodology[71]:	The MPI is an application of the adjusted headcount ratio, $M0$, based on a household level. It identifies the set of indicators in which households are deprived at the same time and summarizes their poverty profile in a weighted deprivation score. They are identified as multi-dimensionally poor if their deprivation score exceeds a cross-dimensional poverty cutoff. The proportion of poor people (i.e. incidence or headcount ratio, H, of poverty) and their average deprivation score (i.e. the 'intensity' of poverty, A) become part of the final poverty measure; the MPI is calculated by multiplying the incidence of poverty by the average intensity across the poor ($H \times A$). A person, who is deprived in at least one third of the weighted indicators, is identified as poor. People identified as 'Vulnerable to Poverty' are deprived in 20% – 33.33% of weighted indicators and those identified as in 'Severe Poverty' are deprived in 50% or more of the components. The MPI uses information from 10 indicators which are organized into three components: health, education and living standards. Below is a list of the components, indicators, deprivation cutoffs and weights of the MPI: 1) Education: Years of Schooling - No household member has completed five years of schooling (1/6) 2) Education: Child School Attendance - Any school-aged child is not attending school up to class 8 (1/6) 3) Health: Child Mortality - Any child has died in the family (1/6) 4) Health: Nutrition Any adult or child for whom there is nutritional information is malnourished (1/6) 5) Living Standard: Electricity - The household has no electricity (1/18) 6) Living Standard: Improved Sanitation - The household's sanitation facility is not improved , or it is improved but shared with other households (1/18) 7) Living Standard: Improved Drinking Water - The household does not have access to improved drinking water or safe drinking water is more than a 30-minute walk from home, roundtrip (1/18) 8) Living Standard: Flooring - The household has a dirt, sand or dung floor (1/18) 9) Living Standard: Cooking Fuel - The household cooks with dung, wood or charcoal (1/18) 10) Living Standard: Assets ownership - The household does not own more than one radio, TV, telephone, bike, motorbike or refrigerator and does not own a car or truck (1/18)
Formula:	MPI = H x A = (incidence or headcount ratio) x (intensity of poverty)
Method of aggregation:	Sum of deprivations
Range and interpretation:	0-1, with 0 being the least multidimensionally poor and 1 being the most multidimensionally poor

[70] United Nations Development Programme, n.d.
[71] *Ibid.*

Components:			

Multidimensional Poverty Index (MPI)	Education: Years of Schooling
	Education: Child School Attendance
	Health: Child Mortality
	Health: Nutrition
	Living Standard: Electricity
	Living Standard: Improved Sanitation
	Living Standard: Improved Drinking Water
	Living Standard: Flooring
	Living Standard: Cooking Fuel
	Living Standard: Assets Ownership

Key Human Development components included:

Expanding Human Capabilities:	Health, Education, Standards of Living
Creating Supportive Environments for Human Development:	N/A
Data used:	The MPI uses micro data from household surveys, and the same survey must be used for all indicators. The two main databases that the MPI uses are publicly available and comparable for most developing countries: the Demographic and Health Survey (DHS) and the Multiple Indicators Cluster Survey (MICS). For several countries, the national household surveys with the same or similar content and questionnaires are used - Argentina, 2005 Encuesta Nacional de Nutrición y Salud (ENNys); Brazil, 2012 Pesquisa Nacional por Amostra de Domicílios (PNAD); China, 2009 China's Health and Nutrition Survey; Mexico, 2012 Encuesta Nacional de Salud y Nutricion (ENSANUT); State of Palestine, 2006/2007 Palestinian Family Health Survey (PAPFAM), and South Africa, 2012 National Income Dynamics Study (NIDS).
Produced by:	The MPI is a measure of acute global poverty developed by the Oxford Poverty and Human Development Initiative (OPHI) with the United Nations Development Programme's Human Development Report, and it belongs to the family of measures developed by Alkire and Foster.
Used by:	Intended for everyone as well as any multiple levels of policy makers.[72]
Link:	http://hdr.undp.org/en/content/multidimensional-poverty-index-mpi OR http://www.ophi.org.uk/multidimensional-poverty-index/
Geographical Coverage:	110 Countries in 2014[73]
MDGs coverage:	MDGs 1, 2, 4 & 7
Developed in year:	2010	Available for time-series:	2010-2015

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[72] Klugman, 2010.
[73] Oxford Poverty & Human Development Initiative, n.d.

Time-series comparability:	Yes (Changes to the MPI were estimated over time for 34 countries in 2014 where suitable data were available.)[74]	Frequency of measurement:	Biannual (starting 2014/2015)[75]
Evaluation of the index – ease of interpretation:			
Number of indicators Linear Calculates dispersion/variability across indicators	10 Yes No		
Normalized Equal weighting	No No		

Other Strengths:
- The MPI has very flexible applications; it could be applied at various levels – village, state, or nation.[76,77] The dimensions, cutoffs, weights and poverty cutoffs could all vary depending on the needs of the users.[78]
- The MPI is grounded in the capability approach, which is the basis of HDI.[79]
- Eight of the MPI's ten indicators relate to MDG targets.[80,81,82,83] It could also provide a multifaceted picture of national performance on the SDGs.[84,85,86]
- The MPI is the first international measure to reflect the intensity of poverty, demonstrated by the number of overlapping deprivations each household faces.[87]
- The Alkire Foster method aggregates multiple deprivations to reflect societal poverty in a way that is robust and can identify interconnections among deprivations and improve policy design.[88,89,90]
- As an index constructed using the Alkire Foster method reflects changes in indicators directly, it is also time sensitive, making it an effective monitoring tool. [91,92,93]
- The MPI has been widely reviewed, carefully constructed.[94]
- Deprivations can be compared directly across people living in different regions and countries, as prices and rates of inflation or foreign exchange are not required.[95]
- The AF measures are different from all other multidimensional marginal measures because they are sensitive to the joint distribution of deprivations by looking across indicators for the same individual.[96]
- Because MPI is an aggregation of many components, the authors argue that having this information readily accessible makes it easier for development agencies and governments to decide what to focus on.
- Due to flexibility of the choice of indicators, the measures can be constructed with binary, ordinal, categorical, qualitative, or cardinal data.[97]
- Robustness tests can be applied to test how sensitive the results are to small changes.[98]

Other Weaknesses:
- Data constraints: 1) Since flow data are not available for all components, the indicators include both outputs (such as years of schooling) and inputs (such as cooking fuel) as well as one stock indicator (child mortality, which

[74] Alkire & Vaz, 2014.
[75] Oxford Poverty & Human Development Initiative, n.d.
[76] Alkire & Foster, 2011.
[77] Alkire et al., 2015.
[78] Alkire & Foster, 2011.
[79] Klugman, 2010.
[80] Alkire & Foster, 2011.
[81] Alkire & Santos, 2010.
[82] Rogan, 2015.
[83] Alkire et al., 2015.
[84] Correa, 2015.
[85] Alkire et al., 2015.
[86] Alkire & Sumner, 2013.
[87] Alkire & Santos, 2010.
[88] Oxford Poverty & Human Development Initiative, n.d.b.
[89] Alkire et al., 2015.
[90] Klugman, 2010.
[91] Oxford Poverty & Human Development Initiative, n.d.b.
[92] Alkire et al., 2015.
[93] Alkire & Sumner, 2013.
[94] Rogan, 2015
[95] Alkire et al., 2015.
[96] Lustig, 2011.
[97] The Economist, 2010.
[98] *Ibid.*

could reflect a death that was recent or long ago); 2) the health data are relatively weak and overlook some groups' deprivations especially for nutrition; 3) subjective judgements were involved in handling missing data; 4) intra-household inequalities may be severe, but these could not be reflected[99]; 5) it does not measure inequality among the poor, although decompositions by group can be used to reveal group-based inequalities; 6) the MPI estimates are based on publicly available data, which limits direct cross-country comparability; and 7) the MPI could not include the component of gender differences[100] and empowerment. [101,102]

- Same set of indicators are used in rural and urban areas; deprivations in rural areas are different than those facing the urban populations.[103] It is also not useful for middle-income countries.[104]
- The MPI index rarely covers poverty caused by migration due to war or climate.[105]
- Individuals living in households with no children (or no history of children) are identified as non-deprived in school attendance and child mortality (as are households with no women), thus the MPI is biased towards households with children and women of reproductive age (although Santos and Alkire (2011) report preliminary evidence suggesting that this bias is not significant).[106]
- Ravallion's main criticisms of the MPI are that:
  - any aggregate index can be problematic or misleading because of its implicit marginal rate of substitution across indicators;[107]
  - due to data constraints, the MPI ended up with fewer components included than the typical consumption-based unidimensional indices;[108,109,110,111,112]
  - prices are missing in the MPI (i.e., not all goods are market goods) or not reliable (i.e., market prices are distorted and do not reflect true social valuations; they are not shadow prices).[113]
  - the six "living standard" indicators are likely to be correlated with consumption or income, but they are unlikely to be very responsive to economic fluctuations;[114]
  - the MPI is not supported by economic theories or practice[115] because the MPI aggregates "apples and oranges" and that there is no consensus exists on how the multiple components should be weighted to form the composite index.[116]
- The MPI assumes that no correlation exists between the various types of deprivations.[117]
- It is insensitive to deprivations both above and below the first cut-off[118]
- The selection of the MPI components is not grounded in participation of poor men and women. [119]

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[99] Rippin, 2011.
[100] International Women's Development Agency, n.d.
[101] Oxford Poverty & Human Development Initiative, n.d.
[102] Klugman, 2010.
[103] Satterthwaite, 2014.
[104] The Economist, 2010.
[105] Correa, 2015
[106] Rogan, 2015.
[107] Lustig, 2011.
[108] *Ibid.*
[109] Ravallion, 2010, July 28.
[110] International Women's Development Agency, n.d.
[111] Ravallion, 2010, October 14.
[112] Ravallion, 2011.
[113] Lustig, 2011.
[114] Ravallion, 2010, July 28.
[115] Ravallion, 2010, October 14.
[116] Ravallion, 2010, July 28.
[117] Rippin, 2011.
[118] International Women's Development Agency, n.d.
[119] *Ibid.*

Table A.5. Human Asset Index (HAI)

<table>
<tr><td colspan="4" align="center">Human Asset Index (HAI) [120]</td></tr>
<tr><td colspan="4">The Human Asset Index (HAI) is one of the criteria used by the United Nations to identify Least Developed Countries.</td></tr>
<tr><td>Methodology[121]:</td><td colspan="3">The HAI is a composite index of four indicators:
• two indicators of health and nutrition outcomes - Percentage of the population undernourished, Mortality rate for children aged five years or under
• two indicators of education (Gross secondary school enrolment ratio, Adult literacy rate).
Raw data for each indicator is normalized into index values using a max-min procedure. The HAI is then calculated as the simple average of the four equally-weighed component indices, resulting in a range from 0 to 100.</td></tr>
<tr><td>Formula:</td><td colspan="3">$$\text{HAI} = \frac{1}{4}\,(\%\ of\ population\ undernourishe$$ $$+ \frac{1}{4}\,(Mortality\ rate\ for\ children\ aged\ 5\ years\ or\ under)$$ $$+ \frac{1}{4}\,(Gross\ secondary\ schol\ enrolment\ ratio) + \frac{1}{4}\,(Adult\ literacy\ rate)$$ Source: UN DESA</td></tr>
<tr><td>Method of aggregation:</td><td colspan="3">Simple Mean</td></tr>
<tr><td>Range and interpretation:</td><td colspan="3">0-100</td></tr>
<tr><td colspan="4">Components:

Human Asset Index (HAI)

Percentage of population undernourished   Mortality rate for children aged five years or under   Gross secondary school enrolment ratio   Adult literacy rate</td></tr>
<tr><td colspan="4">Key Human Development components included:</td></tr>
<tr><td colspan="2">Expanding Human Capabilities:</td><td colspan="2">Health, Education</td></tr>
<tr><td colspan="2">Creating Supportive Environments for Human Development:</td><td colspan="2">N/A</td></tr>
<tr><td>Data used:</td><td colspan="3">Data sources include United Nations (FAO), Food Security Statistics, United Nations Inter-agency Group for Child Mortality Estimation, and UNESCO Institute for Statistics.</td></tr>
<tr><td>Produced by:</td><td colspan="3">United Nations</td></tr>
<tr><td>Used by:</td><td colspan="3">United Nations</td></tr>
<tr><td>Link:</td><td colspan="3">http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_criteria.shtml</td></tr>
<tr><td>Geographical Coverage:</td><td colspan="3">132 Countries</td></tr>
<tr><td>MDGs coverage:</td><td colspan="3">MDGs 1, 2 & 4</td></tr>
<tr><td>Developed in year:</td><td>2006</td><td>Available for time-series:</td><td>Data available for 2006, 2009, 2012 and 2015</td></tr>
<tr><td>Time-series comparability:</td><td>No (moving threshold)</td><td>Frequency of measurement:</td><td>Triennial</td></tr>
<tr><td colspan="4">Evaluation of the index – ease of interpretation:
Number of indicators   4
Linear   Yes
Calculates dispersion/variability across indicators   No
Normalized   Yes
Equal weighting   Yes</td></tr>
</table>

[120] Closset, Feindouno, & Goujon, 2014.
[121] *Ibid.*

Other Strengths:
• The United Nations Department of Economic and Social Affairs (UNDESA)-considers the HAI index to be particularly well-suited indicator to inform aid allocation decisions, since it is used to determine the LDC category.[122]
• HAI is more 'output oriented', focusing on outcomes and results with respect to the state of human capital; it complements the MPI and HDI which are more 'input oriented', taking stock of opportunities, capabilities and deprivations.[123]
Other Weaknesses:

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[122] Markova, 2013.
[123] *Ibid.*

Table A.6. Human Development Index (HDI)

Human Development Index (HDI)

A composite index that assesses a country's achievement in the following components of human development: citizens having a long and healthy life, being knowledgeable and having a decent standard of living.[124] The HDI was created in order to account for human development measures not accounted for in economic indices (GDP, PPP).[125]

Methodology:	HDI is a geometric mean of normalized indices for these three indicators:[126]
	 • LI (Life Expectancy) = $\frac{(Life\ Expectancy - 20)}{(85 - 20)}$
	 • EI (Education Index) = $\frac{(Mean\ Years\ of\ Schooling)/15 + (Expected\ Years\ of\ Schooling/18)}{2}$
	     ○ Where mean years of schooling is the years that a 25 year old or older has spent in school
	     ○ Where expected years of schooling is the years that a 5-year-old will spend in school over his lifetime
	 • II (Income Index) = $\frac{\ln(GNI) - \ln(100)}{\ln(75,000) - \ln(100)}$
	 Where GNI is the gross national income at purchasing power parity per capita

Formula:	HDI = $\sqrt[3]{LEI * EI * II}$
Method of aggregation:	Geometric Mean[127]
Range and interpretation:	The HDI ranges from 0 to 1, with a score of 1 representing the highest level of human development possible, and a score of 0 representing the lowest level of human development possible.[128] In 2014 countries ranged from .337 to .994.[129]
Components:	

Human Development Index
- Health — Life expectancy at birth
- Education — Mean years of schooling; Expected years of schooling
- Living standards — Gross national income per capita

Key Human Development components included:	
Expanding Human Capabilities:	Education, Health, Standard of Living
Creating Supportive Environments for Human Development:	N/A
Data used:	Data from international agencies and other credible data sources. Data availability is a key determinant in country coverage.[130]
Produced by:	United Nations Development Programme [131]
Used by:	Governments, media, academics, private businesses and nonprofits
Link:	http://hdr.undp.org/en/content/human-development-index-hdi
Geographical Coverage:	185 countries, as well as Hong Kong and Palestine [132]
MDGs coverage:	MDG 1, 2
Developed in year:	1990 [133]	**Available for time-series:**	1980-2014 [134]

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[124] United Nations Development Programme, 2014e.
[125] *Ibid.*
[126] United Nations Development Programme, 2013b.
[127] *Ibid.*
[128] United Nations Development Programme, 2014e.
[129] *Ibid.*
[130] United Nations Development Programme, 2014b.
[131] United Nations Development Programme, 2014e.
[132]*Ibid.*
[133]*Ibid.*
[134]*Ibid.*

Time-series comparability:	Yes – after 2010, the HDI switched to using fixed benchmarks for normalization	Frequency of measurement:	Annually
Evaluation of the index – ease of interpretation:			
Number of indicators Linear Calculates dispersion/variability across indicators Normalized Equal weighting	3 No Yes Yes Yes		
Other Strengths:			
• Data are available and credible for most countries. The Human Development Report is produced each year to compare countries.[135] [136] [137] [138] [139] [140] [141] [142] • The HDI accounts for human development indicators that are not accounted for within GDP.[143] [144] [145] [146] [147]			
Other Weaknesses:			
• A number of critics have argued that the HDI should not assign equal weighting to each component.[148] [149] [150] [151] [152] [153] [154] [155] [156] [157] [158] • The HDI does not consider inequalities, poverty, human security, or empowerment. The United Nations Development Index has created the Inequality-adjusted HDI (IHDI), Gender Inequality Index (GII), Multidimensional Poverty Index (MPI), and Gender Development Index (GDI) to attempt to capture these components of human development.[159] [160] [161] [162] [163] [164] • Data are not necessarily accurate due to country-published bias.[165] [166] [167] [168]			

[135] United Nations Development Programme, 2014e.
[136] Eren, Çelik, & Kubat, 2014.
[137] Vidyattama, 2013.
[138] Morse, 2013.
[139] Dervis & Klugman, 2011.
[140] Segura & Moya, 2009.
[141] Antony & Visweswara Rao, 2007.
[142] Perera, Skully, & Wickramanayake, 2005.
[143] Eren, Çelik, & Kubat, 2014.
[144] López Ruiz et al., 2014.
[145] Permanyer, 2013.
[146] Natoli & Zuhair, 2011.
[147] Tokuyama & Pillarisetti, 2009.
[148] Eren, Çelik, & Kubat, 2014.
[149] Permanyer, 2013.
[150] Pinar, Stengos, & Topaloglou, 2013.
[151] de Muro, Mazziotta, & Pareto, 2011.
[152] Natoli & Zuhair, 2011.
[153] Korsakiene, Breivyte, & Wamboye, 2011.
[154] Tokuyama & Pillarisetti, 2009.
[155] Ray, 2008.
[156] Stapleton & Garrod, 2007.
[157] Ivanova, Arcelus, & Srinivasan, 1999.
[158] McGillivray, 1991.
[159] United Nations Development Programme, 2014b.
[160] Morse, 2013.
[161] Stapleton & Garrod, 2007.
[162] Perera, Skully, & Wickramanayake, 2005.
[163] Mazumdar, 2003.
[164] Noorbakhsh, 1998.
[165] López Ruiz et al., 2014.
[166] Stapleton & Garrod, 2007.
[167] Tokuyama & Pillarisetti, 2009.
[168] Wolff, Chong, & Auffhammer, 2011.
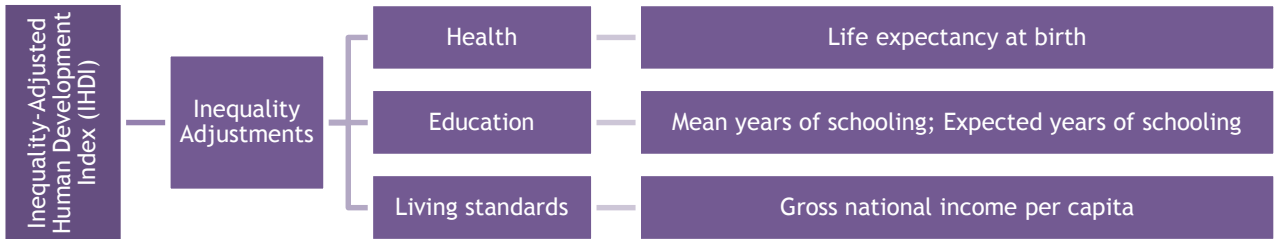
Table A.7. Inequality-Adjusted HDI (IHDI)

Inequality-Adjusted HDI (IHDI)	
The Inequality-adjusted Human Development Index (IHDI) uses Human Development Index (HDI) as the basis but adjusts for inequality in the distribution of each indicator across the population.[169]	
Methodology[170]:	The IHDI is a geometric mean of geometric means, calculated across the population for each indicator separately. By discounting each indicator's average value according to its level of inequality, the IHDI reflects inequalities within each HDI indicator. The three steps in calculating IHDI are: 1) Measuring inequality in each HDI indicator 2) Adjusting the indicator indices for inequality 3) IHDI is calculated as the geometric mean of the three indicator indices adjusted for inequality.
Formula:	$$IHDI = \sqrt[3]{\tau_{Life} \cdot \tau_{Education} \cdot \tau_{Income}}$$ $$= \sqrt[3]{(1 - A_{Life}) . I_{Life} . (1 - A_{Education}) . I_{Education} . (1 - A_{Income}) . I_{Income}}$$
Method of aggregation:	Geometric mean of geometric means
Range and interpretation:	0-1
Components:	

Key Human Development components included:	
Expanding Human Capabilities:	Health, Education, Standards of Living
Creating Supportive Environments for Human Development:	Income Equality
Data used:	For IHDI 2013[171]: • Life expectancy at birth: UNDESA (2011) • Mean years of schooling: Barro and Lee (2011) and HDRO updates based on UNESCO Institute for Statistics (2012) data on education attainment using the methodology outlined in Barro and Lee (2010) • Expected years of schooling: UNESCO Institute for Statistics (2012) • GNI per capita: World Bank (2012a), IMF (2012), UNSD (2012a) and UNDESA (2011)
Produced by:	UNDP
Used by:	UNDP, media, and nonprofits
Link:	http://hdr.undp.org/en/content/inequality-adjusted-human-development-index-ihdi
Geographical Coverage:	145 Countries[172]

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[169] United Nations Development Programme, 2015d.
[170] *Ibid.*
[171] United Nations Development Programme, 2013b.
[172] United Nations Development Programme, 2015d.

MDGs coverage:	MDGs 1 & 2		
Developed in year:	2010[173]	Available for time-series:	2010-2014
Time-series comparability:	Yes	Frequency of measurement:	Annual

Evaluation of the index – ease of interpretation:

Number of indicators	6
Linear	No
Calculates dispersion/variability across indicators	Yes
Normalized	Yes
Equal weighting	Yes

Other Strengths:
- The Atkinson index is used in the construction of IHDI, so IHDI satisfies subgroup consistency (i.e. changes in the distribution of human development within a subgroup of society (with human development remains constant in other subgroups) will be reflected in changes in the overall measure of human development).[174]
- Its path independency allows the same results no matter what order in which data are aggregated across individuals, or groups of individuals, and across indicators; that means estimation for a large number of countries is possible. [175]

Other Weaknesses:
- It is not association sensitive (because data for each individual do not come from a single survey source), thus not capturing overlapping inequalities. [176,177]
- It is not sensitive to joint distribution of different human development components.[178]

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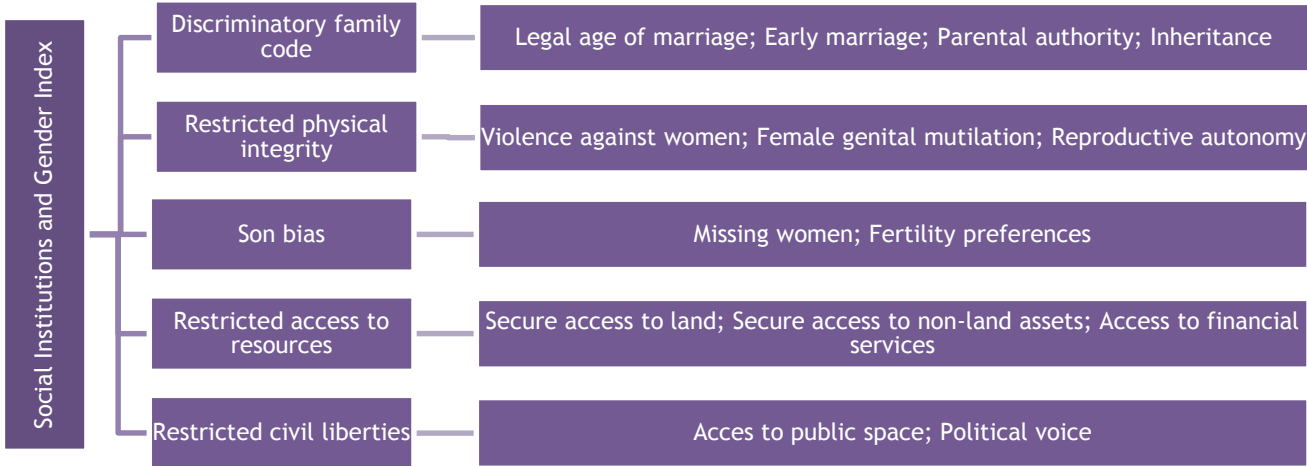
[173] *Ibid.*
[174] *Ibid.*
[175] *Ibid.*
[176] *Ibid.*
[177] Klugman, 2010.
[178] Harttgen & Klasen, 2012.

Table A.8. Social Institutions and Gender Index (SIGI)

Social Institutions and Gender Index (SIGI)

The OECD Development Centre's Social Institutions and Gender Index (SIGI) is a national level measure of discrimination against women in social institutions (formal and informal laws that impede access to justice and rights, social norms, and practices that restrict access to education, health and employment opportunities) across 160 countries.[179] It does not focus on outcomes but on institutions that affect the outcomes.[180]

Methodology[181]:	The SIGI covers five components of discriminatory social institutions, spanning major socio-economic areas that affect women's lives: discriminatory family code, restricted physical integrity, son bias, restricted resources and assets, and restricted civil liberties. These are quantified using discriminatory social institutions such as unequal inheritance rights, early marriage, violence against women, and unequal land and property rights. Principal Components Analysis (PCA) is used at the sub-index level to get an index for the 5 components that are then averaged using squares.
Formula:	$$\text{SIGI} = \frac{1}{5}(Discriminatory\ family\ code)^2 + \frac{1}{5}(Restricted\ physical\ integrity)^2 + \frac{1}{5}(Son\ bias)^2$$ $$+ \frac{1}{5}(Restricted\ resources\ and\ assets)^2 + \frac{1}{5}(Restricted\ civil\ liberties)^2$$ Polychoric PCA to build sub-indices
Method of aggregation:	Simple Mean
Range and interpretation:	0 (low inequality) – 1 (high inequality)
Components:	

Key Human Development components included:	
Expanding Human Capabilities:	N/A
Creating Supportive Environments for Human Development:	Gender Equality, Social Development and Governance
Data used:	Gender, Institutions and Development (GID) Database and other datasets like Demographic and Health Survey, World Health Organization, Population Reference Bureau, Multiple Cluster Indicator Surveys and others
Produced by:	OECD Development Centre
Used by:	OECD, research institutions and researchers
Link:	http://genderindex.org/

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[179] OECD, n.d.
[180] Klasen & Schüler, 2011.
[181] OECD, n.d.

Geographical Coverage:	160 countries		
MDGs coverage:	MDG 3		
Developed in year:	2009[182]	**Available for time-series:**	2009, 2012, 2014
Time-series comparability:	No (methodology has changed over time)[183]	**Frequency of measurement:**	Only 3 rounds available

Evaluation of the index – ease of interpretation:

Number of indicators	14
Linear	Yes
Calculates dispersion/variability across indicators	Yes
Normalized	Yes
Equal weighting	Yes

Other Strengths:
- Penalizes countries with higher inequalities through its quadratic specification.[184]
- Complements other gender indices instead of replacing them by focusing more on the institutional aspect of discrimination.[185]
- Focuses on the causes of the gender inequality, not outcomes.[186]

Other Weaknesses:
- Data limitations:
  - Some indicators only partially capture the component intended to be captured, for example violence indicator is measured using only laws and not actual prevalence.[187]
  - In some components additional indicators can also be included, for example, *physical integrity* can include measures based on institutions associated with reproduction. [188]

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[182] OECD, 2014.
[183] *Ibid.*
[184] van Staveren, 2013.
[185] Branisa et al., 2014.
[186] Potrafke & Ursprung, 2012.
[187] Branisa et al., 2014.
[188] *Ibid.*

Table A.9. Social Progress Index (SPI)

Social Progress Index (SPI)	
The SPI aims to go beyond economic indicators by creating a robust and holistic measurement framework for national social and environmental performance. It is complementary to GDP as a benchmark for progress.[189] The intended audience of SPI is leaders in government, business and civil society with the intended use as a tool to benchmark progress, incentivize policy change, and catalyze action.[190]	
Methodology[191]:	SPI is an aggregate index of 52 social and environmental indicators that capture three components of social progress: basic human needs (nutrition and basic medical care, water and sanitation, shelter, personal safety), foundations of wellbeing (access to basic knowledge, access to information and communications, health and wellness, ecosystems sustainability), and opportunity (personal rights, personal freedom and choice, tolerance and inclusion, access to advanced education).
Formula:	Step 1: $Indicator_c = \sum (w_i * indicator_i)$ where the weights (w in the equation) are determined through Factor Analysis. Step 2: $(X_j - \text{Worst Case})/(\text{Best Case} - \text{Worst Case})$ where X_j is the raw indicator value for each country. Step 3: $Component_d = 1/4 \sum_c Indicator_c$, for all 3 components Step 4: $SPI = 1/3 \sum_d Component_d$ [192]
Method of aggregation:	Factor Analysis and Linear Average
Range and interpretation:	0 (low progress) – 100 (high progress)[193]
Components:	

Key Human Development components included:	
Expanding Human Capabilities:	Education, Health
Creating Supportive Environments for Human Development:	Environmental sustainability, Political freedom and process freedom, Social development and governance
Data used:	The Social Progress Index is an aggregate measure derived from numerous indicators drawn from many different organizations, ranging from very large institutions like the United Nations, to non-governmental organizations such as Transparency International.[194]
Produced by:	Social Progress Imperative[195]

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[189] Porter, Stern, & Green, 2015.
[190] Coplin, 2014.
[191] *Ibid.*
[192] Stern, Wares, & Orzell, 2015.
[193] *Ibid.*
[194] Stern, Wares, & Orzell, 2015.
[195] Porter, Stern, & Green, 2015.

Used by:	Online newspapers and blogs, research institutions and some researchers (in decreasing order of importance)		
Link:	http://www.socialprogressimperative.org/data/spi		
Geographical Coverage:	133 (plus 28 countries with partial data) for 2015 rankings[196]		
MDGs coverage:	MDG 2, 4, 5 & 7		
Developed in year:	2013[197]	Available for time-series:	2013-2015
Time-series comparability:	Yes (methodology different for 2015 but also calculate using 2014 methodology for comparability	Frequency of measurement:	Annual

Evaluation of the index – ease of interpretation :

Number of indicators	53
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	Yes
Equal weighting	No

Other Strengths:
- Less volatile than GDP over time[198]
- Complements GDP per capita and does not replace it. Provides additional information. Allows examination of the two-way relationship of GDP/capita with social progress[199] [200] [201]

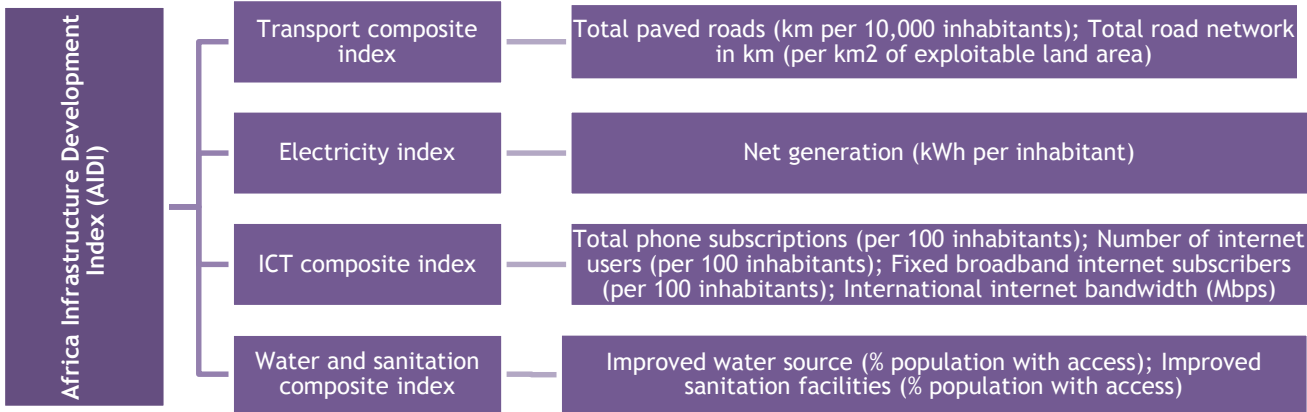**Other Weaknesses:**

[196] *Ibid.*
[197] *Ibid.*
[198] Green, 2015.
[199] D'Urso, 2015.
[200] Porter, 2014.
[201] Reddy, 2014.

Table A.10. Africa Infrastructure Development Index (AIDI)

Africa Infrastructure Development Index (AIDI)[202]

The AIDI is an Africa-specific index that monitors the status and progress of infrastructure development in Africa. The Index is based on the level of transport, electricity, internet and technology, and water and sanitation in each country. The composite index is a weighted average of indicators for each of these components, based on the standard deviation of each component.

Methodology:	The composite index is a weighted average of indicators for each of these components, based on the standard deviation of each component: y = (standard error tot / standard error x) * x; where standard error total = $\sum_x(\frac{1}{s_x})$.
Formula:	Index is a weighted average of indicators for each component (transport, electricity, etc.). Weights are created using the inverse of the standard deviation of each normalized component: $$y_t = \left(\frac{s_{tot}}{s_x}\right) * x_t$$ Where s_{tot} is given by $\frac{1}{s_{tot}} = \sum_x(\frac{1}{s_x})$ and s_x is the standard deviation of the normalized component x.
Method of aggregation:	Weighted Mean
Range and interpretation:	The AIDI ranges from 0 to 100, with 0 indicating poor infrastructure development and 1 equaling advanced infrastructure development.
Components:	

Key Human Development components included:	
Expanding Human Capabilities:	N/A
Creating Supportive Environments for Human Development:	Social Development and Governance
Data used:	Data collected by the AfDB through the Africa Infrastructure Knowledge Program
Produced by:	African Development Bank Group
Used by:	Governments, nonprofits
Link:	http://www.afdb.org/en/documents/project-operations/country-performance-assessment-cpa/country-africa-infrastructure-development-index-aidi/
Geographical Coverage:	53 African countries
MDGs coverage:	MDG 8

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[202] African Development Bank, 2013.

Developed in year:	2011	Available for time-series:	2000-2011[203]
Time-series comparability:	Yes	Frequency of measurement:	Annually until 2011

Evaluation of the index – ease of interpretation:	
Number of indicators	4
Linear	Yes
Calculates dispersion/variability across indicators	Yes
Normalized	Yes
Equal weighting	No

Other Strengths:
- Africa-specific index created by a well-known development group[204]

Other Weaknesses:
- Relatively recent with no additional literature on the index
- Africa-focused

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[203] African Development Bank, 2014.
[204] African Development Bank, 2013.

Table A.11. Better Life Index (BLI)

<table>
<tr><td colspan="2" align="center">Better Life Index (BLI) [205]</td></tr>
<tr><td colspan="2">The Better Life Index is produced by the OECD and used to create individualized indices based on the creator's priorities. It compares well-being across 11 components: community, education, environment, civic engagement, health, housing, income, jobs, life satisfaction, safety, and work-life balance. Data are gathered from the "How's Life? Measuring Well-Being" report/survey that comes out every two years. Prior to individual index creation, all topics are assigned an equal weight of 1, until individuals manually weight importance.</td></tr>
<tr><td>Methodology:</td><td>The Better Life Index is a self-guided index that allows the user to weight the 11 topics by user priority. Before weighting, all 11 topics are weighted equally on the better life scale.</td></tr>
<tr><td>Formula:</td><td>There is no simple formula for the overall Better Life Index. Indicators are aggregated by averaging topics with equal weights. Indicators are normalized using a standard formula which converts the original value of the indicators into ranges from 0 to 1.</td></tr>
<tr><td>Method of aggregation:</td><td>Simple or Weighted Mean</td></tr>
<tr><td>Range and interpretation:</td><td>Each indicator within the Better Life Index can range from 0 to 1, with 0 indicating the worst possible outcome and 1 indicating the best possible outcome. All indicators are then added together to create the user's Index based on preferential weighting.</td></tr>
<tr><td colspan="2">Components:</td></tr>
</table>

Better Life Index		
	Housing	Rooms per person and dwellings with basic facilities; Housing expenditure
	Income	Household net-adjusted disposable income; Household financial wealth
	Jobs	Employment rate; Long term unemployment rate; Job security
	Community	Social support network
	Education	Years in education; Educational attainment; Students' skills
	Environment	Air pollution; Water quality
	Civic Engagement	Voter turnout; Consultation on rule-making
	Health	Life expectancy; Self-reported health
	Life Satisfaction	Life satisfaction
	Safety	Assault rate; Homicide rate
	Work-Life Balance	Employees working long hours; Time devoted to leisure and personal care

Key Human Development components included:

Expanding Human Capabilities:	Health, Education, Standard of Living

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[205] OECD, 2014.

Creating Supportive Environments for Human Development:	Gender Equality, Environmental Sustainability, Political Freedom and Process Freedom, Social Development and Governance
Data used:	Data comes from official sources like the OECD or National Accounts, UN statistics, and National Statistics Offices, as well as Gallup World Poll information.
Produced by:	Organization for Economic Cooperation and Development (OECD)
Used by:	Media, private citizens
Link:	http://www.oecdbetterlifeindex.org/
Geographical Coverage:	34 Countries (OECD member nations)
MDGs coverage:	MDG 1, 2, 3, 7, 8

Developed in year:	2011	**Available for time-series:**	2011-2015
Time-series comparability:	No (methodology is still being adjusted)	**Frequency of measurement:**	Annually

Evaluation of the index – ease of interpretation:			
Number of indicators	11		
Linear	Yes		
Calculates dispersion/variability across indicators	No		
Normalized	Yes		
Equal weighting	Varies		

Other Strengths:
- Allows private citizens to create their own indices based on their preferences and priorities.
- Includes 11 different components of human development for a well-rounded index.

Other Weaknesses:
- Indices and rankings will differ based on the user's self-created, weighted index.
- Indices may only be created for the 34 OECD member nations, and therefore cannot be compared to other non-OECD countries.

Table A.12. Ease of Doing Business Index (EDBI)

Ease of Doing Business Index (EDBI) [206]	
Created by the World Bank, the Ease of Doing Business Index measures economies based on how conducive the nation is for business operations. The index ranks 189 countries in order from most-friendly to business operations to least-friendly to business operations. The index uses 10 business-oriented topics in the World Bank's Doing Business Project to determine the rankings.	
Methodology[207]:	The Ease of Doing Business Index is created in two steps: the first step calculates the simple average of percentile rankings on component indicators for each of its ten topics, while the second step averages the percentile rankings of the ten business topics. The ten topics are: starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency.
Formula:	Ease of Doing Business Index = Average of a country's percentile rank of the ten business topics discussed above.
Method of aggregation:	Simple average of percentile rankings
Range and interpretation:	Countries are ranked from 1 to 189, with 1 indicating the country whose economy is most conducive for business operations and 189 indicating the country whose economy is least conducive for business operations.[208]

Components:

Key Human Development components included:	
Expanding Human Capabilities:	N/A
Creating Supportive Environments for Human Development:	Social Development & Governance
Data used:	World Bank's Doing Business Project data
Produced by:	World Bank
Used by:	Governments, media, academics, private businesses and nonprofits

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[206] The World Bank, 2014a.
[207] The World Bank, 2015b.
[208] The World Bank, 2014a.

Link:	http://data.worldbank.org/indicator/IC.BUS.EASE.XQ		
Geographical Coverage:	189 countries		
MDGs coverage:	MDG 8		
Developed in year:	2006	Available for time-series:	2006-2014
Time-series comparability:	Yes	Frequency of measurement:	Annually

Evaluation of the index – ease of interpretation :

Number of indicators	10
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	Yes
Equal weighting	Yes

Other Strengths:
- Includes multiple indicators of business success[209]

Other Weaknesses:
- Does not consider other aspects of human development besides business indicators[210] [211] [212]
- Not used as a primary indicator of human development[213]

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[209] The World Bank, 2015b.
[210] Ravallion, 2010.
[211] The World Bank, 2015b.
[212] The World Bank, 2014a.
[213] *Ibid.*

Table A.13. Genuine Progress Indicator (GPI)

Genuine Progress Indicator (GPI) [214]	
The Genuine Progress Indicator (GPI) measures changes in national economic welfare with a single, aggregate index.	
Methodology:	Genuine Progress Indicator (GPI) uses GDP as a foundation. While GDP is a measure of current income, GPI is designed to measure the sustainability of that income, essentially measuring whether progress is a result of living off the interest of community capital or spending it down. On top of the same personal consumption data as GDP, the GPI then makes deductions to account for income inequality and costs of crime, environmental degradation, and loss of leisure and additions to account for the services from consumer durables and public infrastructure as well as the benefits of volunteering and housework. Because the GPI takes into account activities that diminish and enhance both natural and social capital, it is designed to measure sustainable economic welfare rather than economic activity alone.
Formula:	A mathematical formula is not available, but the calculation is based on additions to and subtractions from the GDP accounts.
Method of aggregation:	Linear addition and subtraction
Range and interpretation:	N/A
Components:	

Key Human Development components included:	
Expanding Human Capabilities:	Standards of Living
Creating Supportive Environments for Human Development:	Environmental Sustainability, Social Development and Governance
Data used:	GPI uses country-level data. For example, data sources for calculating GPI for the U.S. include U.S. Census Bureau, the Bureau of Economic Analysis, Bureau of Labor Statistics, Bureau of Justice, etc.
Produced by:	Refining Progress
Used by:	It is intended to be adaptable for use by researchers seeking to evaluate the effects of past policy on welfare growth. It is used regularly by governmental and non-governmental organizations worldwide.
Link:	http://rprogress.org/sustainability_indicators/genuine_progress_indicator.htm
Geographical Coverage:	GPI calculations are available for several OECD countries and a few cities and regions within countries.[215]
MDGs coverage:	MDGs 1, 2 & 7
Developed in year:	1995	**Available for time-series:**	Not Specified

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[214] Talberth, Cobb, & Slattery, 2007.
[215] Jacobs & Šlaus, 2010.

Time-series comparability:	Yes	Frequency of measurement:	Not Specified

Evaluation of the index – ease of interpretation:

Number of indicators	26
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	No
Equal weighting	Yes

Other Strengths:
- The GPI is a more meaningful indicator of the well-being of the nation's households than GDP because it takes into account the value of services derived from real wealth and assets.[216]
- Like GDP, it is a currency denominated index and bases itself on GDP consumption data.[217]
- It is a better measure of economic welfare than GDP because of its addition/deduction methodology which reflects net contributions to natural and social capital stocks.[218]

Other Weaknesses:
- Some question the GPI's ability to measure sustainable welfare or its methodological soundness (e.g. it fails to fully account for changes in human-health capital[219]).[220]

[216] Talberth, Cobb, & Slattery, 2007.
[217] Jacobs & Šlaus, 2010.
[218] Kubiszewski et al., 2013.
[219] Lawn, 2013.
[220] Talberth, Cobb, & Slattery, 2007.

Table A.14. Adjusted Net Savings (Genuine Savings)

Adjusted Net Savings (Genuine Savings) [221] [222]			
Adjusted Net Savings (also known as Genuine Savings) measures whether a country is progressing towards sustainable development. Adjusted Net Savings specifically measures whether a country's decrease in natural capital is compensated for by investment in other assets (ex: human capital, infrastructure, etc.).			
Methodology:	Adjusted net savings are equal to net national savings plus education expenditure and minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide and particulate emissions damage.		
Formula:	ANS = Net National Savings + Education Expenditure – Energy Depletion – Mineral Depletion – Net Forest Depletion – Carbon Dioxide and Particulate Emissions Damage		
Method of aggregation:	Simple Summation		
Range and interpretation:	N/A		
Components:			

Key Human Development components included:	
Expanding Human Capabilities:	Education, Standard of Living
Creating Supportive Environments for Human Development:	Environmental Sustainability

Data used:	Data and estimates are based on sources and methods in World Bank's "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (2011).		
Produced by:	The World Bank		
Used by:	The World Bank, Governments		
Link:	http://siteresources.worldbank.org/EXTSDNET/Resources/Little-Green-Data-Book-2013.pdf http://data.worldbank.org/indicator/NY.ADJ.SVNG.GN.ZS		
Geographical Coverage:	120 countries		
MDGs coverage:	MDG 1, 2, 7		
Developed in year:	2013	**Available for time-series:**	1995-1999 is first 5-year data set available
Time-series comparability:	Yes	**Frequency of measurement:**	5-year data sets

Evaluation of the index – ease of interpretation:

Number of indicators	6
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	No
Equal weighting	Yes

Other Strengths:
- Adjusted Net Savings monitors intergenerational equity so that the population today is not using resources in a way that compromises the quality of life and aspirations of the population tomorrow.

Other Weaknesses:

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[221] The World Bank, 2014b.
[222] The World Bank, 2013b.

Table A.15. Global Food Security Index (GFSI)

Global Food Security Index (GFSI) [223]	
The Global Food Security Index (GFSI) aims to determine country vulnerability to food insecurity. The GFSI is developed by the Economist Intelligence Unit (EIU) as a dynamic quantitative and qualitative benchmarking model. It is constructed from 28 indicators that measure drivers of food security across 109 countries.	
Methodology:	Scores for three categories (Affordability, Availability, and Quality & Safety) are calculated from the weighted mean of underlying indicators; the overall score for the GFSI (from 0-100) is calculated from a simple weighted average of the category scores. The weighting assigned to each category and indicator can be changed to reflect different assumptions about their relative importance. Two sets of weights are provided in the index: 1) neutral weights, which assume equal importance of all indicators and evenly distribute weights, and 2) the default model, averages the suggested weights from an expert panel. Indicator scores are normalized and then aggregated across categories. Normalization is based on: $x = (x - Min(x)) / (Max(x) - Min(x))$, where $Min(x)$ and $Max(x)$ are, respectively, the lowest and highest values in the 109 economies for any given indicator. The normalized value is then transformed from a 0-1 value to a 0-100 score. For the indicators where a high value indicates an unfavorable environment for food security (e.g. volatility of agricultural production or political stability risk), normalization then uses: $x = (x - Max(x)) / (Max(x) - Min(x))$ where $Min(x)$ and $Max(x)$ are, respectively, the lowest and highest values in the 109 economies for any given indicator. The normalized value is then transformed into a positive number on a scale of 0-100 for the final score.
Formula:	A mathematical formula is not available, but the calculation is based on a weighted-average aggregation across three categories of 28 indicators.
Method of aggregation:	Weighted Mean
Range and interpretation:	0 to 100, where 100 is the most favorable
Components:	

Key Human Development components included:	
Expanding Human Capabilities:	Health, Standards of Living
Creating Supportive Environments for Human Development:	Income Equality, Social Development and Governance
Data used:	For the quantitative indicators, GFSI draws data from national and international statistical sources. Where quantitative or survey data were missing values, estimates are used.[224] GFSI's main data sources are the EIU; the World Bank Group; IMF;FAO, UNDP, WHO; WTO; the World Food Programme (WFP); Agricultural Science and Technology Indicators (ASTI); and national statistical offices.
Produced by:	The Economist Intelligence Unit (EIU)

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[223] The Economist Intelligence Unit, 2015.
[224] *Ibid.*

Used by:	Governments, media, and nonprofits		
Link:	http://foodsecurityindex.eiu.com		
Geographical Coverage:	109 countries		
MDGs coverage:	MDG 1 & 8		
Developed in year:	2012	Available for time-series:	2012-2015
Time-series comparability:	Yes	Frequency of measurement:	Annual

Evaluation of the index – ease of interpretation :

Number of indicators	28
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	Yes
Equal weighting	No

Other Strengths:
- The GFSI mostly covers indicators of risk to and determinants for the three components of food and nutrition security (FNS), making it a rather comprehensive indicator of FNS.[225]

Other Weaknesses:
- As with other composite indices, a given score in GFSI is meaningless in terms of policy action without a clear understanding of the factors which led to that score. [226]
- There is no clear theoretical concept to support the choice of variables to represent the three components. [227]
- The component of quality and safety only partly covers the different concepts encompassed in the more global component of utilization (e.g. health issues as risks to and determinants of food security are ignored). [228]

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[225] Pangaribowo, Gerber, & Torero, 2013.
[226] *Ibid.*
[227] *Ibid.*
[228] *Ibid.*

Table A.16. Global Gender Gap Index (GGI)

Global Gender Gap Index (GGI)	
The Global Gender Gap Index examines the gap between men and women in four categories: Economic Participation and Opportunity, Educational Attainment, Health and Survival and Political Empowerment.[229] It is composed of 14 different variables.[230] Three basic concepts underlie the Global Gender Gap Index, forming the basis of the choice of indicators, how the data are treated and the scale used: 1) it focuses on measuring gaps rather than levels, 2) it captures gaps in outcome variables rather than gaps in input variables, and 3) it ranks countries according to gender equality rather than women's empowerment.[231]	
Methodology:	The four-step process in calculating the Global Gender Gap Index[232]: **Convert to ratios:** All data are converted to female/male ratios, ensuring that the Index is capturing gaps between women and men's attainment levels, instead of the levels themselves. **Truncate data at equality benchmark:** These ratios are truncated at the "equality benchmark". For all variables, except the two health variables, this equality benchmark is considered to be 1, meaning equal numbers of women and men. This process helps assign the same score to a country that has reached parity between women and men and one where women have surpassed men. **Calculate subindex scores:** Weighted average of the variables within each subindex is then calculated to create the subindex scores. Averaging the different variables would implicitly give more weight to the measure that exhibits the largest variability or standard deviation. Thus, variables are first normalized by equalizing their standard deviations. This way of weighting variables ensures that each variable has the same relative impact on the subindex. **Calculate final scores:** All subindices has the highest possible score of 1 (equality) and the lowest possible score of 0 (inequality), thus binding the scores between inequality and equality benchmarks. Each subindex score is aggregated using un-weighted average to calculate the overall Global Gender Gap Index score, resulting in a score ranges between 1 (equality) and 0 (inequality). The equality and inequality benchmarks remain fixed across time, allowing the reader to track individual country progress in relation to an ideal standard of equality.
Formula:	A mathematical formula is not available, but the calculation is based on a weighted average at the sub-index level and an unweighted-average aggregation at the final index level.
Method of aggregation:	Sub-index level: Weighted average / Final index level: unweighted-average
Range and interpretation:	1 (equality) and 0 (inequality)
Components:	

Economic Participation and Opportunity — Ratios of women and men in 1) Gap in labour force participation rates; 2) earned income and wage equality for similar work, and 3) legislators, senior officials and managers, and technical and professional workers

Educational Attainment — Ratios of women to men in 1)primary-, secondary- and tertiary-level education; and 2) literacy rate

Health and Survival — 1) Sex ratio at birth, and 2) healthy life expectancy ratio

Political Empowerment — Ratios in 1) Seats in Parliament, 2) Ministerial level, and 3) the number years of a female head of state

Key Human Development components included:	
Expanding Human Capabilities:	Health, Education, Standards of Living

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[229] Hausmann et al., n.d.
[230] World Economic Forum, n.d.
[231] *Ibid.*
[232] *Ibid.*

Creating Supportive Environments for Human Development:	Gender Equality, Income Equality, Political Freedom and Process Freedom, Social Development and Governance		
Data used:	Data sources include: World Economic Forum, International Labor Organization, UNESCO, CIA, WHO, and Inter-Parliamentary Union.		
Produced by:	World Economic Forum		
Used by:	Research community, including the UNDP[233], and the media.		
Link:	http://reports.weforum.org/global-gender-gap-report-2014/part-1/		
Geographical Coverage:	142 Countries		
MDGs coverage:	MDGs 2, 3 & 8		
Developed in year:	2006	Available for time-series:	2006-2014[234]
Time-series comparability:	Yes	Frequency of measurement:	Annual

Evaluation of the index – ease of interpretation :

Number of indicators	14
Linear	Yes
Calculates dispersion/variability across indicators	Yes
Normalized	No
Equal weighting	Yes

Other Strengths:
- The option of roughly interpreting the final Index scores as a percentage value that reveals how a country has reduced its gender gap should help make the Index more intuitively appealing to readers. [235]

Other Weaknesses:
- The World Economic Forum's Global Gender Gap Index (GGI) differs from the GII in that it measures gender gaps but ignores the absolute achievements. While this is useful, it can also be somewhat misleading.[236]
- Interpretation of the index and comparisons over time can be difficult because the index is calculated by converting data into male/female ratios, which are then truncated according to an "equality benchmark" and a somewhat elaborate weighting procedure.[237]

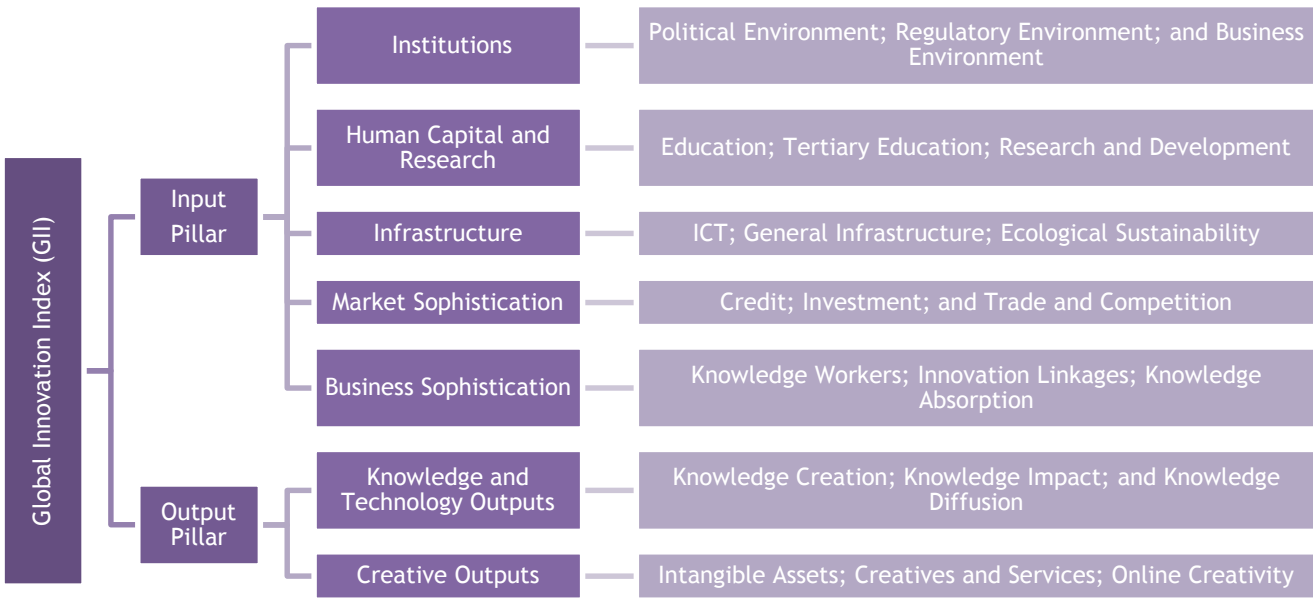[233] Klugman et al., 2010.
[234] Hausmann et al., n.d.
[235] *Ibid.*
[236] Klugman et al., 2010.
[237] Klasen & Schüler, 2011.

Table A.17. Global Innovation Index

Global Innovation Index[238]

The Global Innovation Index project was created in 2007 with a goal of determining how to find metrics and approaches that better capture national innovation capabilities. The conceptual framework is revised each year with the intention to improve the way innovation is measured.

Methodology:	Global Innovation Index consists of two sub-indices: the Innovation Input Sub-Index and the Innovation Output Sub-Index. **For the Innovation Input Sub-Index**, five input pillars capture elements of the national economy that enable innovative activities: (1) Institutions, (2) Human capital and research, (3) Infrastructure, (4) Market sophistication, and (5) Business sophistication. **For the Innovation Output Sub-Index**, two output pillars capture actual evidence of innovation outputs: (6) Knowledge and technology outputs and (7) Creative outputs. Each pillar is divided into sub-pillars and each sub-pillar is composed of 81 individual indicators; sub-pillar scores are aggregate weighted average of individual indicators and pillar scores are aggregate weighted average of sub-pillar scores. The following final scores are calculated: - The **Innovation Input Sub-Index** is calculated as the simple average of the five input pillar scores; - The **Innovation Output Sub-Index** is the simple average of the two output pillar scores; - The **overall GII** is the simple average of Innovation Input Sub-Index and Innovation Output Sub-Index; and - The **Innovation Efficiency Ratio** is Output Sub-Index divided by the Input Sub-Index
Formula:	$$GII = \frac{(\text{Innovation Input SubIndex } + \text{ Innovation Output SubIndex})}{2}$$
Method of aggregation:	Simple Mean
Range and interpretation:	0-100, with higher scores representing better outcomes. (Scores are normalized in the 0–100 range except for the Innovation Efficiency Ratio, for which scores revolve around the number 1 as this index is calculated as the ratio between the Output and Input Sub-Indices).
Components:	

Input Pillar	Institutions	Political Environment; Regulatory Environment; and Business Environment
	Human Capital and Research	Education; Tertiary Education; Research and Development
	Infrastructure	ICT; General Infrastructure; Ecological Sustainability
	Market Sophistication	Credit; Investment; and Trade and Competition
	Business Sophistication	Knowledge Workers; Innovation Linkages; Knowledge Absorption
Output Pillar	Knowledge and Technology Outputs	Knowledge Creation; Knowledge Impact; and Knowledge Diffusion
	Creative Outputs	Intangible Assets; Creatives and Services; Online Creativity

(Global Innovation Index (GII) → Input Pillar / Output Pillar)

Key Human Development components included:	
Expanding Human Capabilities:	Education

[238] Cornell University, INSEAD, & WIPO, 2014.

Creating Supportive Environments for Human Development:	Environmental Sustainability, Political Freedom and Process Freedom, Social Development and Governance		
Data used:	The Global Innovation Index gathers data from more than 30 sources, including World Bank's World Governance Indicators; Ease of Doing Business Index; UNESCO, OECD, etc. covering a large spectrum of innovation drivers and results; privileging hard data over qualitative assessments (only five survey questions are included this year).		
Produced by:	Cornell University, INSEAD, and the World Intellectual Property Organization(WIPO, an agency of the United Nations, UN		
Used by:	Media and nonprofits		
Link:	www.globalinnovationindex.org		
Geographical Coverage:	143 Countries		
MDGs coverage:	MDGs 2, 7 & 8		
Developed in year:	2007	Available for time-series:	2007-2014
Time-series comparability:	No (The model is revised every year as it continuously seeks to update/improve the way innovation is measured.)	Frequency of measurement:	Annual
Evaluation of the index – ease of interpretation : Number of indicators 81 Linear Yes Calculates dispersion/variability across indicators No Normalized Yes Equal weighting Yes			
Other Strengths:			
Other Weaknesses:			

Table A.18. Index of Economic Freedom (IEF)

Index of Economic Freedom (IEF)

The Index of Economic Freedom (IEF), published by the Wall Street Journal and the Heritage Foundation, measures economic policy developments in 186 countries and territories since the second half of 2013.[239]

Methodology:	The Index of Economic Freedom (IEF) measures economic freedom based on 10 quantitative and qualitative factors, grouped into four broad categories, or pillars, of economic freedom: • Rule of Law (property rights, freedom from corruption); • Limited Government (fiscal freedom, government spending); • Regulatory Efficiency (business freedom, labor freedom, monetary freedom); and • Open Markets (trade freedom, investment freedom, financial freedom).[240] Each of these ten factors is graded on a scale of 0 to 100, and these ten freedom scores are aggregated, with equal weight being given to each to obtain a country's overall score.[241]
Formula:	A mathematical formula is not available, but the calculation is based on aggregation of 10 equally-weighted variables.
Method of aggregation:	Simple Mean
Range and interpretation:	0-100

Components:

Key Human Development components included:

Expanding Human Capabilities:		Standards of Living
Creating Supportive Environments for Human Development:		Political Freedom and Process Freedom, Social Development and Governance
Data used:		Not specified
Produced by:		The Wall Street Journal and the Heritage Foundation,
Used by:		Researchers, media, and nonprofits
Link:		http://www.heritage.org/index/about
Geographical Coverage:		186 Countries
MDGs coverage:		MDG 8

Developed in year:	1995	**Available for time-series:**	1995-2015
Time-series comparability:	Yes	**Frequency of measurement:**	Annual

Evaluation of the index – ease of interpretation :

Number of indicators	10
Linear	Yes

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[239] The Heritage Foundation, 2015a.
[240] The Heritage Foundation, 2015b
[241] *Ibid.*

Calculates dispersion/variability across indicators	No
Normalized	No
Equal weighting	Yes

Other Strengths:
- The correlation between the economic freedom variables of the IEF and indicators of growth has proved to be positive and significant in the study by De Hann and Sturm.[242]

Other Weaknesses:
- Some of the underlying theories that supports their choice of indicators are questionable, especially the way government spending and taxes are taken up (the underlying theory about taxation is a deterrent of economic freedom). [243]

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[242] de Haan & Sturm, 2000.
[243] *Ibid.*

Table A.19. The Legatum Prosperity Index (LPI)

<table>
<tr><td colspan="2" align="center">The Legatum Prosperity Index (LPI) [244]</td></tr>
<tr><td colspan="2">The Legatum Prosperity Index is a global measurement of prosperity based on both income and wellbeing. It ranks over 140 countries based on a variety of factors including wealth, economic growth and quality of life.</td></tr>
<tr><td>Methodology[245]:</td><td>The Legatum Prosperity Index is composed of 89 indicators, which are spread across eight sub-indices (Economy, Entrepreneurship & Opportunity, Governance, Education, Health, Safety & Security, Personal Freedom, and Social Capital).

Calculation:

Income and Wellbeing Scores. The latest data available were gathered from each country for the 89 indicators. The raw values are standardized and multiplied by the weights. The weighted variable values are then aggregated to obtain a country's wellbeing and income score in each sub-index. The income and wellbeing scores are also standardized so that they can be compared.
Sub-index Scores. The standardized income and wellbeing scores are added together to create the countries' sub-index scores. These sub-index scores are also used to rank countries.
The Final Prosperity Index Score. The Prosperity Index score is calculated by a simple average of the eight equally-weighed sub-indices. The overall Prosperity Index rankings are based on this score.

Normalization Process: Each of the 89 indicators is standardized by subtracting the mean and dividing by the standard deviation.

Indicator weights: Regression analysis was used to determine the weight of each indicator. The coefficients derived from the regression are the weights and they represent relative importance to either income or wellbeing outcomes.</td></tr>
<tr><td>Formula:</td><td>$$PI_T(S) = \left[\left(\frac{1}{8} \right) S_{1,T} + \cdots + \left(\frac{1}{8} \right) S_{\beta,T} \right]$$
Source: Legatum Institute
At the final level of the Legatum Prosperity Index, "aggregation assumes perfect substitutability between each sub-index (ß =1), equal weights (wi =1), and the transformation function is the identity function".[246]</td></tr>
<tr><td>Method of aggregation:</td><td>Simple Mean</td></tr>
<tr><td>Range and interpretation:</td><td>(-x to + x) Scores range from positive to negative values and values close to zero rank near the middle of the Index. [247]</td></tr>
</table>

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[244] Legatum Institute, 2015a.
[245] *Ibid.*
[246] Legatum Institute, 2013.
[247] Legatum Institute, 2015a.

Components:

The Legatum Prosperity Index		
	Economy	Unemployment; Inflation; Satisfaction with Living Standard etc.
	Entrepreneurship & Opportunity	Business Start-up Costs; R&D Expenditure etc.
	Governance	Rule of Law; Government Effectiveness; Confidence in the Judicial System etc.
	Education	Gross Secondary Enrolment; Girls-to-Boys Enrolment; Pupils-toTeacher Ratio etc.
	Health	Infant Mortality Rate; Life Expectancy; Level of Worrying etc.
	Safety & Security	Theft; Safe Walking Along at Night; Civil War etc.
	Personal Freedom	Tolerance for Minorities; Civil Liberties etc.
	Social Capital	Volunteering; Trust Others; Donations etc.

Key Human Development components included:

Expanding Human Capabilities:	Health, Education, Standards of Living
Creating Supportive Environments for Human Development:	Environmental Sustainability, Political Freedom and Process Freedom, Social Development and Governance

Data used:	All survey data used in the Index is from the Gallup World Poll. [248]		
Produced by:	Legatum Institute		
Used by:	It is intended for use by leaders and decision makers around the world.[249]		
Link:	http://www.prosperity.com/#!/		
Geographical Coverage:	142 Countries		
MDGs coverage:	MDGs 1, 2, 4, 6, 7 & 8		
Developed in year:	2008[250]	**Available for time-series:**	2008-2014
Time-series comparability:	Yes	**Frequency of measurement:**	Annual

Evaluation of the index – ease of interpretation :

Number of indicators	89
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	Yes
Equal weighting	Yes

Other Strengths:
- The study by Otoiua, Titanb & Dumitrescu validates the LPI as a reliable measure of well-being.[251] The authors noticed that the HPI is in fact correlated with very few well-being variables they chose; by contrast, the HDI and LPI appear to be strongly correlated with almost all indicators.[252]

Other Weaknesses:
- The four main potential sources of error Legatum Institute identifies: 1) Errors in the data due to potential inaccuracies in country-level statistics and indicators, 2) variable weights are measured with different levels of precision indicated by their standard errors, 3) sub-indices being equally weighted for the aggregation of the

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[248] Legatum Institute, 2013.
[249] Legatum Institute, 2015b.
[250] Legatum Institute, 2015a.
[251] Otoiu, Titan, & Dumitrescu, 2014.
[252] *Ibid.*

income and wellbeing components thus may generate a degree of uncertainty, and 4) potential misspecifications in the modelling can produce errors that affect the Prosperity Index scores.[253]

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[253] Legatum Institute, 2013.

Table A.20. Quality of Growth Index (QGI)

<table>
<tr><td colspan="2" align="center">Quality of Growth Index (QGI) [254]</td></tr>
<tr><td colspan="2">This index emphasizes the importance of "inclusiveness" in debates on growth and qualifies as all the underlying aspects of inclusive growth as "quality of growth". "Good quality growth is high, durable and socially-friendly growth."</td></tr>
<tr><td>Methodology[255]:</td><td>This composite index combines the intrinsic nature of growth ("growth fundamentals") and its social components (desired social outputs from growth).</td></tr>
<tr><td>Formula:</td><td>

$QGI = \alpha \left(Fundamentals \right) + \beta \left(Social \right)$

with "growth fundamentals" component defined as

$Fundamentals = \gamma_1 Level + \gamma_2 Stability + \gamma_3 Diversification + \gamma_4 Orientation$

"social component" defined as $Social = \delta_1 School + \delta_2 Health$
</td></tr>
<tr><td>Method of aggregation:</td><td>Uses equal weighting arithmetic mean but also uses geometric mean for robustness purposes</td></tr>
<tr><td>Range and interpretation:</td><td>0 (low quality of growth) – 1 (high quality of growth)</td></tr>
<tr><td colspan="2">Components:
</td></tr>
<tr><td colspan="2">Key Human Development components included:</td></tr>
<tr><td>Expanding Human Capabilities:</td><td>Health; Education; Standard of Living</td></tr>
<tr><td>Creating Supportive Environments for Human Development:</td><td>N/A</td></tr>
<tr><td>Data used:</td><td>various databanks, including the IMF World Economic Outlook database, the World Bank's World Development Indicators (WDI) database, COMTRADE, the International Country Risk Guide database, Barro and Lee (2010)[256] and Xala-i-Martin (2006)[257][258]</td></tr>
<tr><td>Produced by:</td><td>International Monetary Fund</td></tr>
<tr><td>Used by:</td><td>Relatively new index, so it's not very widely used at the moment</td></tr>
<tr><td>Link:</td><td>http://www.imf.org/external/pubs/ft/wp/2014/wp14172.pdf</td></tr>
<tr><td>Geographical Coverage:</td><td>90 countries</td></tr>
</table>

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[254] Mlachila, Tapsoba, & Tapsoba, 2014.
[255] *Ibid.*
[256] Barro & Lee, 2013.
[257] Sala-i-Martin, 2006.
[258] Mlachila, Tapsoba, & Tapsoba, 2014.

MDGs coverage:	MDG 1,2 & 4			
Developed in year:	2014		Available for time-series:	1990-2011
Time-series comparability:	Yes		Frequency of measurement:	Only once in 2014
Evaluation of the index – ease of interpretation:				
Number of indicators Linear Calculates dispersion/variability across indicators Normalized Equal weighting	6 Yes No Yes Yes			
Other Strengths:				
Other Weaknesses: • The quality of underlying social data is weak;[259] • The index does not include measures of inequality;[260] • The index does not predict long term sustainability.[261]				

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[259] *Ibid.*
[260] *Ibid.*
[261] *Ibid.*

Table A.21. African Gender and Development Index (AGDI)

African Gender and Development Index (AGDI) [262]	
The African Gender and Development Index (AGDI) was created in 2004 to give policymakers in Africa a regional tool to measure progress towards gender equality. The AGDI consists of two parts: the Gender Status Index (GSI), which covers those aspects of gender relations that can be measured quantitatively, and the African Women's Progress Scoreboard (AWPS) that captures qualitative issues of gender policies in African governments. The AGDI is best used in combination with other indices, such as the HDI. The AGDI covers 12 countries: Uganda, Tanzania, Benin, Burkina Faso, Ghana, Cameroon, South Africa, Mozambique, Egypt, Tunisia, Ethiopia, and Madagascar.	
Methodology:	The AGDI breaks the GSI into three blocks: 1) Social Power (referring to capabilities) 2) Economic Power (referring to opportunities) 3) Political Power (referring to agency or ability to influence and contribute to outcomes) GSI: all 44 GSI indicators receive equal weight within the 13 subcomponents that make up the 7 components of GSI. This allows the Social Power, Economic Power, and Political Power blocks to receive equal weights when calculating the GSI. The AGDI breaks the AWPS into four blocks: 1) Women's rights 2) Social Power (referring to capabilities) 3) Economic Power (referring to opportunities) 4) Political Power (referring to agency or ability to influence and contribute to outcomes) AWPS: The AWPS uses a three-point scoring system (0, 1, or 2) to score each indicator. This allows countries to see progression each year. Each block receives equal weight, similarly to the GSI. The AWPS is then measured as a percentage from 0 – 100%.
Formula:	GSI = (Social Power + Economic Power + Political Power)/3 AWPS = (Women's Rights + Social Power + Economic Power + Political Power)/4
Method of aggregation:	Simple Mean (female/male) for each indicator. The indicators are then averaged within each block and the blocks are then averaged to determine the AGDI.
Range and interpretation:	Each Indicator may range from 0-2 as a ratio. An AGDI of 0 would indicate perfect inequality for women compared to men, while an AGDI of 2 would indicate perfect inequality for men compared to women. A score of 1 indicates perfect equality.

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[262] Economic Commission for Africa, 2011.

Components:

Gender Status Index (GSI)

- Social power 'capabilities'
  - Education — Enrollment, Completion, Literacy
  - Health — Child health, HIV/AIDS
- Economic power 'opportunities'
  - Income — Wages, Income
  - Time-use and Employment — Time use, Employment
  - Access to resources — Means of production, Management
- Political power 'agency'
  - Public Sector — Members of parliament, cabinet ministers, etc.
  - Civil Society — Senior positions in political parties, trade unions, etc.

African Women's Progress Scorecard (AWPS)

- Women's Rights — CEDAW, Solemn declaration on gender equality in Africa, etc.
- Social Power — Violence against women, education, health, harmful practices, domestic violence, etc.
- Economic Power — Equal access to resources, land rights, etc.
- Political Power — Role of women in governance, support for women's quota and affirmative action, etc.

Key Human Development components included:

1. Expanding Human Capabilities:	Education, Health, Standard of Living
2. Creating Supportive Environments for Human Development:	Gender Equality, Political Freedom & Process Freedom, Social Development & Governance

Data used:	National data from participating countries
Produced by:	United Nations Economic Commission for Africa (UNECA)
Used by:	African governments, international organizations
Link:	http://www.uneca.org/sites/default/files/PublicationFiles/agdi_2011_eng_fin.pdf
Geographical Coverage:	12 Countries in Africa, with the hope of expanding to 30 in the future
MDGs coverage:	1, 2, 3, 4, 6

Developed in year:	2004	**Available for time-series:**	2000-2011
Time-series comparability:	Yes	**Frequency of measurement:**	Every 5 years

Evaluation of the index – ease of interpretation:

Number of indicators	44
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	No
Equal weighting	Yes

Other Strengths:
- The AGDI is a combination of quantitative and qualitative indicators.
- It includes the measurement of policies to promote women's rights and to combat violence against women.
- The AGDI's equal weighting allows for easy calculation.
- Data are collected at the national level and therefore has more detailed analysis.

Other Weaknesses:
- AGDI only measures the gender gap, irrespective of the general socioeconomic performance of a country. The AGDI must thus be used in combination with measures that do indicate such absolute levels, such as the Human Development Index (HDI) or the HPI.
- Identity and personal choice are not covered.
- The AGDI uses national data which can allow for data manipulation.
- The AGDI does not refer to non-gender oppression, such as race, ethnicity, religion, ability, the rural/urban gap and age.
- Africa-focused.

Table A.22. Happy Planet Index (HPI)

Happy Planet Index (HPI) [263]

The Happy Planet Index (HPI) is an "efficiency measure which captures the degree to which long and happy lives are achieved per unit of environmental impact".

Methodology:	The HPI is an aggregate of three indicators: 1) Experienced well-being – based on data from Gallup World Poll 'Ladder of Life' 2) Life expectancy – HPI 2012 used data from the 2011 UNDP Human Development Report 3) Ecological Footprint - The HPI uses the Ecological Footprint promoted by the environmental charity WWF as a measure of resource consumption. Two Steps for Calculating Happy Planet Index: 1) Happy Life Years are calculated by multiplying the ladder of life score by life expectancy for each country. 2) The final HPI is calculated by dividing Happy Life Years by Ecological Footprint. Statistical adjustments, through "moderating the degree of variation in the individual components", are applied to both stages of calculation to "ensure that no single component of the HPI dominates either Happy Life Years or the final HPI score". Life expectancy is treated as a reference, and statistical adjustments are applied to the ladder of life and Ecological Footprint.
Formula:	Happy Planet Index = ϕ × ((Ladder of life + α) x Life expectancy) - ∏ / (Ecological Footprint + ß) where: α = 2.93, ß = 4.38, ∏ = 73.35, φ = 0.60
Method of aggregation:	The HPI score is calculated using the mean ladder of life score and mean life expectancy for each country.
Range and interpretation:	0-100, with 100 being the happiest

Components:

Key Human Development components included:

Expanding Human Capabilities:	Health
Creating Supportive Environments for Human Development:	Environmental Sustainability
Data used:	Gallup World Poll 'Ladder of Life', Life expectancy data from UNDP Human Development Report, and the Ecological Footprint by WWF
Produced by:	Nic Marks, Founder of the Centre for Well-being at the New Economics Foundation
Used by:	Intended for use by governments and nonprofits around the world
Link:	http://www.happyplanetindex.org/about/
Geographical Coverage:	151 Countries
MDGs coverage:	MDG 7
Developed in year:	2006	**Available for time-series:**	Only 3 rounds available (2006, 2009, and 2012)

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[263] New Economics Foundation, 2015.

Time-series comparability:	No (inconsistent data available for different years for each country)[264]	Frequency of measurement:	Only 3 rounds available (2006, 2009, and 2012)

Evaluation of the index – ease of interpretation:

Number of indicators	3
Linear	Yes
Calculates dispersion/variability across indicators	No
Normalized	No
Equal weighting	No

Other Strengths:
- It gives a comprehensive picture of sustainable societal well-being as it integrates subjective and objective indicators.[265]

Other Weaknesses:
- The study by Otoiua, Titanb & Dumitrescu (2014) invalidates the HPI as a reliable measure of well-being because they found that the HPI is correlated with very few well-being variables they chose or other similar well-being indicators. This result echoes the criticisms made by mainstream media that HPI results are not a good measure of well-being (e.g. The Wall Street Journal and Tim Harford, in his book "The Undercover Economist Strikes Back").[266]
- With its strong focus on the environment, this index is biased towards countries near the equator.[267]

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[264] New Economics Foundation, 2012.
[265] Costanza, et al., 2014.
[266] Otoiu, Titan, & Dumitrescu, 2014.
[267] Bergheim & Schneider, 2006.

Table A.23. Safe Cities Index

<table>
<tr><td colspan="4" align="center">Safe Cities Index[268]</td></tr>
<tr><td colspan="4">In 2015 The Economist Intelligence Unit (sponsored by NEC) launched a new index, The Safe Cities Index that measures urban safety and security.</td></tr>
<tr><td>Methodology:</td><td colspan="3">This index measures the relative level of safety of a diverse mix of the world's leading cities using four main classifications of safety: digital security, health security, infrastructure safety and personal safety.</td></tr>
<tr><td>Formula:</td><td colspan="3">$$\frac{(\text{digital security}) + (\text{health security}) + (\text{infrastructure safety}) + (\text{personal safety})}{4}$$</td></tr>
<tr><td>Method of aggregation:</td><td colspan="3">Simple Mean – all indicators weighted equally to measure category scores, and equal weighting of the four categories to get Safe Cities Index.</td></tr>
<tr><td>Range and interpretation:</td><td colspan="3">0 (best city) -100 (worst city)</td></tr>
<tr><td colspan="4">Components:</td></tr>
<tr><td colspan="4">

Safe Cities Index

- Digital Security — Dedicated cyber security teams (input) and the frequency of identity theft (output)
- Health security — Ratio of hosiptal beds (input) and life expectancy (output)
- Infrastructure safety — Quality of roads (input) and the number of natural disasters (output)
- Personal safety — Level of police engagement (input) and the prevalence of violent crime (output)

</td></tr>
<tr><td colspan="4">Key Human Development components included:</td></tr>
<tr><td colspan="2">Expanding Human Capabilities:</td><td colspan="2">Health</td></tr>
<tr><td colspan="2">Creating Supportive Environments for Human Development:</td><td colspan="2">Environment Sustainability, Social Development and Governance</td></tr>
<tr><td>Data used:</td><td colspan="3">Data collected by in-house researchers; data from similar Economist Intelligence Unit indices that measure city competitiveness, livability, etc.; publicly available information from official sources.</td></tr>
<tr><td>Produced by:</td><td colspan="3">The Economist Intelligence Unit</td></tr>
<tr><td>Used by:</td><td colspan="3">The Economist</td></tr>
<tr><td>Link:</td><td colspan="3">http://safecities.economist.com/</td></tr>
<tr><td>Geographical Coverage:</td><td colspan="3">50 cities across 5 continents</td></tr>
<tr><td>MDGs coverage:</td><td colspan="3">MDG 4, 5 & 7</td></tr>
<tr><td>Developed in year:</td><td>2015</td><td>Available for time-series:</td><td>Just one year 2015</td></tr>
<tr><td>Time-series comparability:</td><td>No (New)</td><td>Frequency of measurement:</td><td>Measured once</td></tr>
<tr><td colspan="4">Evaluation of the index – ease of interpretation:

Number of indicators   44
Linear   Yes
Calculates dispersion/variability across indicators   No
Normalized   Yes
Equal weighting   Yes</td></tr>
<tr><td colspan="4">Other Strengths:</td></tr>
<tr><td colspan="4">Other Weaknesses:</td></tr>
</table>

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[268] The Economist, 2015.

Appendix B: Literature Search Methodology

To explore existing indexes that aim to measure country progress on human development and generate a list of relevant measures, we conducted searches on **Scopus**, **Google**, and **Google Scholar**. The screening criteria we used to focus our search were a discussion of either "human development" or "indices" related to measurement of country progress. The following sections describe our search and screening methodology in detail. Our search, screening, and coding processes are also captured in an Excel spreadsheet.

<u>Initial Search and Screening</u>

At the initial screening stage, we identified potential sources from Scopus and Google using search strings related to the terms "human development" and "index", and screened these results to determine whether they were relevant for this review. We obtained 316 results from Scopus, of which 95 were retained. In the Google search, we used 10 different search strings aimed at eliciting different areas of the literature, and reviewed the first 100 results from each search string. A total of 196 results were shortlisted for review based on our criteria. The **291 sources** from this initial search and screening described **120 potentially relevant indices** measuring country-level human development progress. A list of search strings used in each database and the numbers of result generated are summarized in Table B.1.

Table B.1. Search Strings Used and Search Results in Scopus and Google

SCOPUS	GOOGLE

Search String:
TITLE-ABS-KEY ("human development" OR "human capacity" OR "human freedom" OR "living standard" OR "standard of living" OR "sustainable development" OR "human well-being") AND (composite) AND (indicator* OR measure* OR "index" OR indices) AND (LIMIT-TO(LANGUAGE,"English")) AND (EXCLUDE(SUBJAREA,"ENVI") OR EXCLUDE(SUBJAREA,"ENGI") OR EXCLUDE(SUBJAREA,"AGRI") OR EXCLUDE(SUBJAREA,"BUSI") OR EXCLUDE(SUBJAREA,"MATE") OR EXCLUDE(SUBJAREA,"COMP") OR EXCLUDE(SUBJAREA,"EART") OR EXCLUDE(SUBJAREA,"DECI") OR EXCLUDE(SUBJAREA,"MEDI") OR EXCLUDE(SUBJAREA,"CHEM") OR EXCLUDE(SUBJAREA,"CENG") OR EXCLUDE(SUBJAREA,"MATH") OR EXCLUDE(SUBJAREA,"PHYS") OR EXCLUDE(SUBJAREA,"PSYC") OR EXCLUDE(SUBJAREA,"BIOC") OR EXCLUDE(SUBJAREA,"IMMU") OR EXCLUDE(SUBJAREA,"NURS") OR EXCLUDE(SUBJAREA,"PHAR") OR EXCLUDE(SUBJAREA,"HEAL") OR EXCLUDE(SUBJAREA,"NEUR"))
 	
Results obtained: 316
Shortlisted based on criteria: 95
	Search Strings:
	1. "composite" AND "poverty" AND "development" AND (indicators OR index OR measure)
	    a) **Shortlisted based on criteria:** 24 results
	2. "human" AND ("quality of life" OR "living standard") AND ("measure") AND ("index" OR "indices")
	    a) **Shortlisted based on criteria:** 35 results
	3. ("human development" OR "human capacity" OR "human freedom" OR "human well-being") AND (composite) AND ("indicator" OR "measure" OR "index" OR indices)
	    a) **Shortlisted based on criteria:** 11 results
	4. ("development" OR "equality" OR "security") AND ("composite" OR "comprehensive" OR "multidimensional" OR "country") AND ("index" OR "indices" OR "measurement" OR "indicator")
	    a) **Shortlisted based on criteria:** 27 results
	5. ("development" OR "freedom" OR "standard of living" OR "quality of life") AND ("composite" OR "comprehensive" OR "multidimensional" OR "country") AND ("index" OR "indices" OR "measurement" OR "indicator")
	    a) **Shortlisted based on criteria:** 9 results
	6. ("human capacity" OR "international development" OR "social progress") AND ("composite" OR "comprehensive" OR "multidimensional" OR "country") AND ("index" OR "indices" OR "measurement" OR "indicator")
	    a) **Shortlisted based on criteria:** 14 results
	7. ("human development" OR "poverty") AND ("composite" OR "comprehensive" OR "multidimensional" OR "country") AND ("index" OR "indices" OR "measurement" OR "indicator")
	    a) **Shortlisted based on criteria:** 20 results
	8. ("human development" OR "social progress") AND ("composite" OR "comprehensive" OR "multidimensional" OR "country") AND ("index" OR "indices" OR "measurement" OR "indicator")
	    a) **Shortlisted based on criteria:** 35 results
	9. ("well-being" OR "human development" OR "growth") AND ("composite" OR "comprehensive" OR

	“multidimensional” OR “country”) AND (“index” OR “indices” OR “measurement” OR “indicator”)
	    a) **Shortlisted based on criteria:** 8 results
	10. “human development” AND (“indicator” OR “index” OR “indices”)
	    a) **Shortlisted based on criteria:** 13 results

Second Screening and Supplemental Searches

We further reviewed the 291 sources and filtered the 120 measures identified into a final list of 22 measures based on the screening criteria that indices must be: 1) a composite index measuring multiple component of human development rather than measuring multiple aspects within a single component of human development; 2) a composite index using a method or methods of aggregation (as opposed to dash board measures); 3) current (continues to be updated with empirical data and not specifically being replaced by another index); and 4) a measure that is not merely a proposal (as reflected by discussion or adoption by organizations or people beyond the author).

For each of the 22 measures on the final list, we conducted supplemental searches (using a "snowball" approach) with Google, Google Scholar, and Scopus, targeting the following information:

1. Descriptive information about each index from the index official website as well as other sources, including:
    - The organization(s) or person(s) who created the index
    - Methodology for calculating the index
    - Formula
    - Aggregation method
    - Components and indicators encompassed
    - Range and interpretation of index results
    - The number of countries covered
    - Data sources
    - The year it was developed
    - The range of time-series comparability
    - Cross-country comparability
    - Frequency of measurement, and
    - Traction
2. Information on methodological strengths and weaknesses, including:
    - Whether the methodology is based on a linear equation
    - Whether the index calculate dispersion or variability across indicators
    - If equal weighting is involved
    - If normalization process is used
    - Strengths, and
    - Weaknesses

Summaries of each of the 22 measures on the final list are included in Appendix A. Appendix C includes the main measures that we excluded from the final list.

Appendix C: Other Indicators Designed to Measure Human Development Progress

The following table contains a list of 20 indices that may be used to measure human development progress but were not included in this review. The table includes a description of each indicator and our rationale for not including them in this review.

Indicator	Description	Reasons for
Corruption Perceptions Index[269]	The Corruptions Perceptions Index (CPI) is developed by Transparency International. It scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of reputable institutions. The methodology for the CPI was updated in 2012. The following steps are followed to calculate the CPI: 1. Select data sources: The Corruption Perceptions Index (CPI) 2012 is an aggregate indicator that brings together data from a number of different sources. 2. Standardize data sources to a scale of 0-100 where a 0 equals the highest level of perceived corruption and 100 equals the lowest level of perceived corruption. This is done by subtracting the mean of the data set and dividing by the standard deviation and results in z-scores, which are then adjusted to have a mean of approximately 45 and a standard deviation of approximately 20 so that the data set fits the CPI's 0-100 scale. 3. Calculate the average: For a country or territory to be included in the CPI, a minimum of three sources must assess that country. A country's CPI score is then calculated as the average of all standardized scores available for that country. Scores are rounded to whole numbers. 4. Report a measure of uncertainty: The CPI is accompanied by a standard error and confidence interval associated with the score, which capture the variation in scores of the data sources available for that country/territory. Year to year comparisons will be possible from 2012 onwards. 12 data sources were used to construct the Corruption Perceptions Index 2014: • African Development Bank Governance Ratings 2013 • Bertelsmann Foundation Sustainable Governance Indicators 2014 • Bertelsmann Foundation Transformation Index 2014 • Economist Intelligence Unit Country Risk Ratings 2014 • Freedom House Nations in Transit 2013 • Global Insight Country Risk Ratings 2014 • IMD World Competitiveness Yearbook 2014 • Political and Economic Risk Consultancy Asian Intelligence 2014 • Political Risk Services International Country Risk Guide 2014 • World Bank - Country Policy and Institutional Assessment 2013 • World Economic Forum Executive Opinion Survey (EOS) 2014	The CPI appears to be a widely known index that measures perceived levels of government corruption. However, the indicators the CPI uses focus only on one aspect of a supportive environment, and thus the CPI does not meet our criteria of capturing multiple components of human development.
Development Diamonds[270]	A World Bank-created measurement that shows relationships among the following four socioeconomic indicators for a given country relative to the averages for that country's income group: life expectancy at birth, gross primary enrollment, access to safe water, and GNP per capita. Each are presented on an axis and then connected to form a polygon/diamond. A reference diamond of	This index's exact methodology was difficult to find and it is not a composite index that aggregates

[269] Transparency International. (2015). *Corruption Perceptions Index 2014 - In Detail*. *Transparency.org*. <http://www.transparency.org/cpi2014/in_detail>.
[270] Soubbotina, T. (2004). Beyond Economic Growth, Second Edition An Introduction to Sustainable Development (2nd ed.). Washington, D.C.: World Bank.

	the average indicators for a country's income group is use to compare individual country diamonds.	numerous indicators into a single score.
Economic Vulnerability Index (EVI) [271]	The economic vulnerability index (EVI) measures the structural vulnerability of countries to exogenous economic and environmental shocks. The EVI contains eight indicators, which are grouped into various sub-indices. They are (with their weights in parentheses): 1) population size (weight: 1/8) 2) location remoteness (weight: 1/8) 3) economic structure: merchandise export concentration (weight: 1/16) and share of agriculture, forestry and fisheries in gross domestic product (weight: 1/16) 4) share of the population in low coastal zones (weight: 1/8) 5) instability of exports of goods and services (weight: 1/4) 6) victims of natural disasters (weight: 1/8) 7) instability of agricultural production (weight: 1/8)	Although the EVI is developed and used by the UNDESA to categorize least developed countries, we are unable to find further information about it besides a paragraph on the UNDESA website.[272] In addition, most of the indicators the EVI uses focus on creating a supportive environment in only one component – economic vulnerability.
EFA Development Index (EDI) [273]	The EFA Development Index (EDI) is a composite index that provides a snapshot of overall progress of national education systems towards the six goals of the Education for All movement developed by UNESCO. The value of the standard EDI for a given country is the arithmetic mean of the four components: 1)universal primary education, measured by the primary adjusted net enrolment ratio; 2) adult literacy, measured by the literacy rate for those aged 15 and above; 3) gender parity and equality, measured by the gender-specific EFA index (GEI), an average of the gender parity indices (GPIs) of the primary and secondary gross enrolment ratios and the adult literacy rate; and 4) quality of education, measured by the survival rate to grade 5; in the absence of comparable indicators on quality, notably on learning outcomes, the survival rate is used as a proxy because of its positive correlation with average international learning assessment scores. The EDI value falls between 0 and 1, with 1 representing full achievement of EFA across the four goals.	While the EDI is a composite index developed by UNESCO and it provides a comprehensive view of national education system, it only considers one aspect of human development.
Environmental Performance Index[274]	The Environmental Performance Index (EPI) ranks how well countries perform on high-priority environmental issues in two broad policy areas: protection of human health from environmental harm and protection of ecosystems. The EPI is constructed through the calculation and aggregation of 20 indicators reflecting national-level environmental data. These indicators are combined into nine issue categories, each of which fit under one of two overarching objectives (Environmental Health and Ecosystem Vitality). Environmental Health measures the protection of human health from environmental harm. Ecosystem Vitality measures ecosystem protection and resource management. Each	The EPI considers only environmental factors and therefore does not meet our criteria of capturing multiple components of human development.

[271] United Nations Development Policy and Analysis Division. (2015). UN DESA | DPAD | CDP | Least Developed Countries Criteria. <http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_criteria.shtml>.
[272] *Ibid.*
[273] UNESCO. (2015). *The Education for All Development Index*. <http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/gmr2012-report-edi.pdf>.
[274] United Nations DESA,. (2015). *Indicators of Sustainable Development: Guidelines and Methodologies - October 2007 Third Edition*. Retrieved from http://www.un.org/esa/sustdev/natlinfo/indicators/guidelines.pdf

	indicator is weighted within each policy issue to create a single policy issue score. The EPI is considered by the United Nations Economic and Social Affairs as one of many indicators that are specifically focused on the environmental component of sustainable development and resource management, rather than offering a comprehensive view of sustainable development.	
Environmental sustainability Index[275]	The Environmental Sustainability Index (ESI) is a measure of overall progress towards environmental sustainability. The index provides a composite profile of national environmental stewardship based on a compilation of indicators derived from underlying datasets. The ESI provides a composite profile of national environmental stewardship based on 5 components (environmental systems, reducing environmental stresses, reducing human vulnerability, social and institutional capacity, and global stewardship) with a compilation of 21 indicators that derive from 76 underlying data sets. The ESI uses uniform weighting of the 21 indicators because simple aggregation is transparent and easy to understand.	The ESI considers only environmental factors and therefore does not meet our criteria of capturing multiple components of human development.
Global Entrepreneur-ship Index[276]	The Global Entrepreneurship and Development Index (GEDI), now known as the Global Entrepreneurship Index (GEI)[277], is comprised of three sub-indexes that capture the contextual features of entrepreneurship across individual and institutional variable. The attitude sub-index measures society's basic attitudes toward entrepreneurship through education and social stability. The activity sub-index measures what individuals are actually doing to improve the quality of human resources and technological efficiency. The aspiration sub-index measures how much of the entrepreneurial activity is being directed toward innovation, high-impact entrepreneurship, and globalization. The three entrepreneurial sub-indexes are not of equal importance. GEDI is built using configuration theory, which lowers sub-index scores if there is a shortage or low level score on its components. The most entrepreneurial economies are both broad and deep across most of the components of the 3 GEDI sub-indexes: Attitudes, Activity, and Aspirations.	The GEI only measures entrepreneurship, and therefore does not meet our criteria of capturing multiple components of human development.
Gender Empowerment Measure[278]	The GEM specifically measures "whether women and men are able to actively participate in economic and political life, and take part in decision-making," focusing more on what people are able to do as opposed to overall well-being. The GEM is calculated by using three basic indicators: proportion of seats held by women in national parliaments, percentage of women in economic decision making positions, and female share of income.	The GEM does not meet our criteria of capturing multiple components of human development. The Gender Inequality Index (GII) was developed to address the shortcomings of GEM.[279]

[275] Yale University. (2015). *2005 Environmental Sustainability Index*. <http://www.yale.edu/esi/>.
[276] Autio, E., & Acs, Z. (2010). Intellectual property protection and the formation of entrepreneurial growth aspirations. *Strat.Entrepreneurship J.*, *4*(3), 234-251. doi:10.1002/sej.93
[277] The GEDI. (2015). *GEDI Index*. <http://thegedi.org/global-entrepreneurship-and-development-index/>.
[278] van Staveren, I. (2013). To Measure is to Know? A Comparative Analysis of Gender Indices. *Review Of Social Economy*, *71*(3), 339-372. doi:10.1080/00346764.2012.707398
[279] Klugman, J. (2010). Human Development Report 2010–20th Anniversary Edition. The Real Wealth of Nations: Pathways to Human Development.

Gender Equality Index	The Gender Equality Index measures how far (or close) the EU-27 and its Member States were from achieving complete gender equality in 2010. It provides results at both Member States and EU-27 level. It measures gender gaps that are adjusted to levels of achievement, ensuring that gender gaps cannot be regarded positively where they point to an adverse situation for both women and men. The Gender Equality Index assigns scores for Member States, between 1, total inequality and 100, full equality. It is formed by combining gender indicators, according to a conceptual framework, into a single summary measure. It consists of six core domains (work, money, knowledge, time, power and health) and two satellite domains (intersecting inequalities and violence). It adopts a gender approach instead of a women's empowerment approach.	Its focus is only on gender equality, and therefore does not meet our criteria of capturing multiple components of human development. This index is also focused exclusively on the EU countries.
Gini Coefficient[280]	The Gini Index measures the distribution of income or consumption expenditure among individuals or households and identifies how this measurement deviates from a perfectly equal distribution of income. The index uses a Lorenz curve to plot percentages of total income received against the number of income recipients, while the Gini Index itself measures the area between the Lorenz curve and the line of absolute equality. The Gini Coefficient is therefore the percentage of the maximum area under the line - 0 represents a perfectly equal distribution of income, while 1 is perfectly unequal.	While the Gini coefficient is an influential measure, we exclude it from this paper because it is not a composite index, and because it only focuses on one component of HD – income equality.
Global Well-Being Index[281]	Gallup, a research-based consulting company, develops a number of indices and polls which gain traction among the mainstream media. The Global Well-Being Index measures country citizens' responses to 10 Gallup Poll questions: 1) you like what you do every day, 2) you learn or do something interesting every day, 3) someone in your life always encourages you to be healthy, 4) your friends and family give you positive energy every day, 5) you have enough money to do everything you want to do, 6) in the last seven days, you have worried about money, 7) the city or area where you live is a perfect place for you, 8) in the last 12 months, you have received recognition for helping to improve the city or area where you live, 9) in the last seven days, you have felt active and productive every day, and 10) your physical health is near-perfect. Based on this information, Gallup categorizes respondents as thriving, struggling, or suffering in each element.	We do not include this index nor other human-development related indices by Gallup because of the lack of information published regarding the details on their methodologies, especially the method of aggregation for the Well-Being Index.
Human Poverty Index[282]	The HPI is an indication of standard of living in a country, and has recently been replaced by the UN's Multidimensional Poverty Index.	Although the HPI was an important composite index measuring standard of living, it is no longer in use and has been replaced by the MPI.
Human Poverty Index (HPI-1) - for	HPI-1 formula = [1/3[(probability at birth of not surviving to age 40) + (adult illiteracy rate) + (unweighted average of population without sustainable access to an improved water source and children under weight for age)]^1/3.	The HPI-1 is no longer in use and has been replaced by the MPI.

[280] World Bank. (2015). GINI index (World Bank estimate). <http://data.worldbank.org/indicator/SI.POV.GINI?page=1>.
[281] Standish, M., & Witters, D. (2015). *Country Well-Being Varies Greatly Worldwide*. *Gallup.com*. Retrieved 21 June 2015, from http://www.gallup.com/poll/175694/country-varies-greatly-worldwide.aspx
[282] UNDP. (2015). Frequently Asked Questions - Multidimensional Poverty Index (MPI) | Human Development Reports. <http://hdr.undp.org/en/faq-page/multidimensional-poverty-index-mpi#t295n138>.

developing countries[283]		
Human Poverty Index (HPI-2) - for industrial countries[284]	HPI-2 formula = [1/4[(probability at birth of not surviving to age 60) + (adult illiteracy rate) + (population below income poverty line) + (rate of long term unemployment)]^1/4.	The HPI-2 is no longer in use and has been replaced by the MPI.
Index of Social Progress (ISP)	The Index of Social Progress (ISP) was developed by Richard J. Estes, Professor of Social Work at the University of Pennsylvania. Estes published a number of books based on the studies he has conducted using the ISP on a wide range of countries. The ISP is intended to measure economic development, social and political conditions, and the ability of nations to produce welfare for their citizens.[285] The ISP is composed of 10 sub-indexes using a total of 46 social indicators.[286] The sub-index categories include: Education; Health Status; Women Status; Defense Effort; Economic; Demographic; Geography; Political Participation; Cultural Diversity; and Welfare Effort. A subindex score for each domain is created by conducting separate factor analyses that are run over the nine domains, and these subindices are then further factor analyzed to derive the Weighted Index of Social Progress (WISP).[287]	No details of the methodology for calculating the ISP can be found, and it does not appear to be widely in use.
Index of Sustainable Economic Welfare (ISEW)[288]	The ISEW and the Genuine Progress Indicator (GPI) are developed by the same authors and use the same methodology.[289] The ISEW focuses on two key concepts: essential needs of the world's poor, and the idea of limitations imposed by technology or society that citizens face. The formula for the ISEW is roughly the following: ISEW = personal consumption + public non-defensive expenditures - private defensive expenditures + capital formation + services from domestic labour - costs of environmental degradation - depreciation of natural capital.	Since the GPI is a more widely used measure with the same methodology as the ISEW, we included the GPI but not the ISEW in this review.
MDG Progress Index[290]	The Millennium Development Goals Progress Index measures trends in global and regional progress towards meeting the MDG targets: extreme poverty, hunger, education, gender, child mortality, maternal mortality, HIV/AIDS, and water. The methodology compares a country's performance against required achievement trajectories for each MDG indicator to determine whether a country is above or below that MDG indicator achievement trajectory. The Index is then calculated by aggregating performance across the 8 MDG targets - if a country's improvement is above the required trajectory it receives a 1, with a total Index not exceeding 8 (8*1).	While this index proposes to measure all components of human development covered by the MDGs, it appears to be just a proposal using only two years (2010 and 2011) of empirical data, rather than an index that is widely and repeatedly measured.

[283] United Nations Development Programme (n.d.). Human Development Reports. <http://hdr.undp.org/en/content/multidimensional-poverty-index-mpi>.
[284] United Nations Development Programme (n.d.). Human Development Reports. <http://hdr.undp.org/en/content/multidimensional-poverty-index-mpi>.
[285] Santos, M. E., & Santos, G. (2013). Composite Indices of Development‖. International Development: Ideas, Experience and Prospects. OUP. Chicago
[286] Estes, R. J. (1998). Trends in world social development, 1970–1995. Development challenges for a new century. J Developing Soc, 14, 11-39.
[287] *Ibid.*
[288] Daly, H., Cobb, J., & Cobb, C. (1989). *For the common good*. Boston: Beacon Press.
[289] Lawn, P. A. (2005). An assessment of the valuation methods used to calculate the index of sustainable economic welfare (ISEW), genuine progress indicator (GPI), and sustainable net benefit index (SNBI). *Environment, Development and Sustainability*, 7(2), 185-208.
[290] Center For Global Development, (2015). *MDG Progress Index: Gauging Country-Level Achievements.* <http://www.cgdev.org/page/mdg-progress-index-gauging-country-level-achievements>.

Prescott-Allen's Index of the Wellbeing of Nations[291]	Prescott-Allen's work has to date yielded four indices: the Human Wellbeing Index (HWI); the Ecosystem Wellbeing Index (EWI); the Wellbeing Index (combining the HWI and the EWI, and thus measuring "sustainability"); and the Wellbeing/Stress Index (a ratio of how much harm a given country's development does to the global ecosystem). The Human Wellbeing Index captures 39 indicators of health, population, wealth, education, communication, freedom, peace, crime, and equity, and the Ecosystem Wellbeing Index captures 39 indicators of land health, protected areas, water quality, water supply, global atmosphere, air quality, species diversity, energy use, and resource pressures. The Wellbeing of Nations maps each country's four scores for these different wellbeing indices onto a graph that indicates not only how countries are doing in relation to each other, but also how close they come to achieving "sustainability."	The index does not appear to be widely used and there are too few details on its methodology to include it in this analysis.
Quality of Life Index[292]	The Quality of Life Index assigns equal weights to three basic capabilities: (1) the capability to be well-nourished; (2) the capability for healthy and safe reproduction; (3) and the capability to be educated and be knowledgeable. Based on studies and statistical tests done by AER at the level of households, municipalities, and provinces, the following indicators were selected and utilized to generate the Quality of Life Index: (1) attended births; (2) under-five nutrition; and (3) elementary cohort survival rate.	This index does not appear to be widely used and has been recently changed to the "where-to-be-born index." Data for the Quality of Life index is available for 1988 and 2013.
World Health Organization's Quality of Life measure (WHOQOL) [293]	The WHOQOL is measure linking ecosystem services (ES) and human well-being. It is based on the Millennium Ecosystem Assessment conceptual framework of five components (the basic material for good life, security, health, good social relations, and freedom of choice and action).	The WHOQOL is a survey rather than a composite measure.

[291] Prescott-Allen, R. (2001). *The wellbeing of nations*. Washington, DC: Island Press.
[292] The Economist Intelligence Unit. (2015). *The World in 2005 - The Economist Intelligence Unit's quality-of-life index*. Retrieved from http://www.economist.com/media/pdf/QUALITY_OF_LIFE.pdf
[293] World Health Organization. (2015). *WHO | The World Health Organization Quality of Life (WHOQOL)*. Retrieved 21 June 2015, from http://www.who.int/mental_health/publications/whoqol/en/

Appendix D: Data Availability and Quality

Many indices depend on national and regional data generated by various outside sources for measurement of the various indicators they include. These data are often inaccurate for a variety of reasons, which can affect the reliability of composite indices.

In the book *Poor Numbers*, Jerven (2013) analyzes the development statistics presented by African governments and nonprofits to demonstrate the different statistics that can be presented for the same country. For example, Table E.1 is adapted from Jerven's book comparing the per capita GDP for selected Sub-Saharan African nations based on data gathered by the World Development Indicators (developed by the World Bank Group), Penn World Tables (developed by economists at the University of Pennsylvania), and Angus Maddison (used often by economists and economic historians).

Table E.1. Data for per capita GDP from various sources

Rank	Maddison	Per capita GDP	World Development Indicators	Per capita GDP	Penn World Tables	Per capita GDP
1	Congo-Kinshasa	$217	Congo-Kinshasa	$92	Congo-Kinshasa	$359
2	Sierra Leone	$410	Ethiopia	$115	Liberia	$472
3	Chad	$429	Burundi	$139	Sierra-Leone	$684
4	Niger	$489	Sierra Leone	$153	Burundi	$699
5	Burundi	$496	Malawi	$169	Ethiopia	$725
6	Tanzania	$535	Tanzania	$190	Guinea-Bissau	$762
7	Guinea	$572	Liberia	$191	Niger	$807
8	Central African Rep.	$576	Mozambique	$191	Tanzania	$817
9	Comoro Islands	$581	Niger	$200	Togo	$823
10	Ethiopia	$605	Guinea-Bissau	$210	Madagascar	$823
11	Togo	$614	Chad	$218	Chad	$830
12	Zambia	$645	Rwanda	$242	Malawi	$839
13	Malawi	$656	Burkina Faso	$243	Zambia	$866
14	Guinea-Bissau	$681	Madagascar	$246	Burkina Faso	$933
15	Madagascar	$706	Nigeria	$254	Central African Rep.	$945
16	Angola	$765	Mali	$294	Gambia	$954
17	Uganda	$797	Sudan	$313	Rwanda	$1,018
18	Rwanda	$819	Togo	$323	Mali	$1,047
19	Mali	$892	Kenya	$328	Sudan	$1,048
20	Gambia	$895	Central African Rep.	$339	Uganda	$1,058
21	Burkina Faso	$921	Sao Tome & Principe	$341	Nigeria	$1,074
22	Liberia	$990	Uganda	$348	Mozambique	$1,093
23	Sudan	$991	Gambia	$370	Benin	$1,251
24	Mauritania	$1,017	Zambia	$394	Kenya	$1,268
25	Kenya	$1,031	Ghana	$413	Congo-Brazzaville	$1,286
26	Cameroon	$1,082	Benin	$414	Sao Tome & Principe	$1,300
27	Sao Tome & Principe	$1,226	Comoros	$436	Comoros	$1,359
28	Nigeria	$1,251	Mauritania	$495	Ghana	$1,392
29	Ghana	$1,270	Angola	$524	Mauritania	$1,521
30	Benin	$1,283	Lesotho	$548	Senegal	$1,571
31	Zimbabwe	$1,328	Guinea	$605	Lesotho	$1,834
32	Cote D'Ivoire	$1,352	Senegal	$609	Angola	$1,975
33	Senegal	$1,358	Zimbabwe	$620	Cote D'Ivoire	$2,171
34	Mozambique	$1,365	Cameroon	$675	Cameroon	$2,472
35	Lesotho	$1,490	Cote D'Ivoire	$739	Guinea	$2,546
36	Cape Verde	$1,777	Congo-Brazzaville	$791	Zimbabwe	$3,256
37	Congo-Brazzaville	$2,005	Swaziland	$1,538	Cape Verde	$4,984
38	Swaziland	$2,630	Cape Verde	$1,541	Namibia	$5,269
39	Namibia	$3,637	Equatorial Guinea	$1,599	Equatorial Guinea	$6,495
40	Gabon	$3,847	Namibia	$2,366	Botswana	$7,256
41	South Africa	$3,978	Botswana	$3,931	South Africa	$8,226
42	Botswana	$4,269	South Africa	$4,020	Swaziland	$8,517

43	Seychelles	$6,354	Mauritius	$4,104	Gabon	$10,439
44	Equatorial Guinea	$7,973	Gabon	$4,378	Seychelles	$10,593
45	Mauritius	$10,652	Seychelles	$6,557	Mauritius	$15,121

Source: Adapted from Jerven's *Poor Numbers* (2013)

Measures of per capita GDP differ due to the World Development Indicators, Penn World Tables, and the database of Angus Maddison using different formulas to convert local currency into international U.S. dollars. However, currency conversion formulas would not affect country ranking if this were the only calculation difference. The major issue is that country rankings differ, and sometimes drastically – Liberia ranks as the second poorest country in Penn's rankings, while Maddison ranks Liberia as the 22nd poorest country (Jerven, 2013).

The data sets that these sources draw information from cause these differences in GDP and country rankings. While international organizations and development programs often refer to data as international, Jerven notes that much of these data are national-level data from various states that the international databases then publish (*ibid.*). Other authors have noted that this national data often suffers data errors due to data updating, formula revisions, and country thresholds that change each year (Wolff, et al., 2011; Tokuyama & Pillarisetti, 2009; Stanton, 2007). The lack of validity and reliability of the state-level data therefore weakens the validity and reliability of the national and international data presented (Jerven, 2013). Because of this, one should be cautious when interpreting international data.

Issues with data quality also influence cross-country comparability of indices. Many human development measures were developed with the intent of performing cross-country comparisons. Indices calculated based on data from large international organizations could be more reliably compared across countries as processing of these data likely follow international standards. The United Nations Statistical Division (UNSD) publishes a comprehensive list of international guidelines and recommendations for best practices in the collection, compilation, and presentation of the statistics (Choi & Ward, 2003). However, national definitions, sources, and survey and processing practices still vary greatly across countries (Choi & Ward, 2003; Ravallion, 2003), affecting robust cross-country comparisons. Even for the MPI, which is published by the UNDP and compares the multidimensional poverty incidence and intensity across 110 countries, the authors caution users of its limitation that the MPI estimates are based on publicly available data which limits direct cross-country comparability (Oxford Poverty & Human Development Initiative, 2015).

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